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THE NATURE-STUDY REVIEW

DEVOTED PRIMARILY TO ALL SCIENTIFIC STUDIES OF NATURE IN ELEMENTARY SCHOOLS

OFFICIAL ORGAN OF
AMERICAN NATURE-STUDY SOCIETY

Vol. 8, No. 1
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For the Birds

For the songs they sang when the fields were green,
And the sunshine lay with a golden sheen
O'er the out-of-doors; for this gift we owe
Them a morsel warm when the ice and snow
Cover streams and fields with a mantle chill—
And it's only fair that we pay the bill!

George B. Staff.

THE

NATURE-STUDY REVIEW

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The Washington Meeting

The meeting of the American Nature-Study Society at Washington partook of the enthusiasm and excellence that characterized all the meetings of the American Association for the Advancement of Science and the affiliated organizations. A letter had been sent to all the officers and directors of the society outlining the important topics of discussion as follows:

OXFORD, OHIO, Oct. 21, 1911.

"The annual meeting of the American Nature-Study Society will be held at Washington, D. C. Dec. 27-28.

"Will you kindly make suggestions as to program, either as to its general nature or as to its special subjects.

"I regard this meeting as a very important one, for although the Society is now fairly well established, it has promise of greater development. The meeting should formulate some definite plans for this development. Shall the Society try to reach as large a number of teachers as possible? Or shall its work be limited to a smaller number whose interest in nature-study is already strong? Would it be worth while to emphasize more the subject of agriculture so as to appeal to rural teachers or to those interested in rural education? Would some sort of alliance with the School Garden Association seem desirable? Kindly let me know how you feel on these questions and on any others concerning the policy of the Society, with particular reference to discussions at the next meeting.

"I hope that you are planning to be present and take part in the program. Sincerely yours,

"B. M. DAVIS."

The meeting was called to order by President Davis at the Business High School Dec. 27, at 2:30 P. M.. There were about forty in attendance at the meetings. Nearly every one on the program printed in the December number was present to take part. Only a brief statement of some of the more important points brought out can be mentioned, omitting entirely the remarks of some of the speakers who have promised for early issues an article along the same line.

Mr. C. H. Robison (N. J.) said: "I very much favor Professor Bigelow's suggestion that the Review come out as a quarterly or bi-monthly. I also favor placing it on the same plane as the Elementary School Teacher, School Review, Journal of Educational Psychology and similar journals.

"I would favor also the experiment of issuing supplements for as many of the intervening months as convenient which should be purely informational and popular. This would furnish enough matter to please the rank and file and leave the main issue for such discussions of the problems of nature study as marked the first two years of the magazine.

"I also suggest having a number, say the December issue, preceding the annual meeting contain carefully prepared papers in the nature of these to be argued or discussed at the forthcoming meeting. The June number, preceding the N. E. A. meeting might do the same thing."

Dr. Stanley Coulter (Indiana): "Any organization is effective as it does work. The Nature-Study Society should in my mind have for its first work the reaching of as large a number of teachers as possible. Until this is done the society is merely moving in a circle.

"There should also be an organization of suggestive courses which shall be adapted to the stage of the development of the pupil, which shall be logical and progressive, which shall demand more first hand contact with nature on the part of the child and much less talking on the part of the teacher. Such courses should contain an amount of work which could be performed by the child in the grade for which it is prepared in the time assigned to the subject. This means that the volume of existing courses must be very greatly reduced. There should also be a determination as to what constitutes the real center of the work; whether it is the material used or the intellectual result sought. If the former is the idea, the subject is worthless from an educational standpoint. If the latter, it is one of the best educational tools that we have.

"As a matter of fact the nature study movement does not spread among teachers because as a rule a great majority of them can get no conception as to the content of the subject, as to the methods of administration, or even find a rational course which they can follow. If the society should devote itself to some such lines of work as I have crudely outlined above, the society would grow with great rapidity for teachers, where the subject is presented, are constantly writing to know what the course includes, what materials to select, how to present it, how much time to give to it, etc."

Discussing School Gardens in relation to Nature Study V. E. Kilpatrick, President of the School Garden Association of America said: "We need to take the child out in the open more, believing that there he can be most properly educated. We began our old education with four months school in winter and eight months of out door life. We have extended our school time until it covers ten months and the hours of confinement each day have been increased. This is all wrong. The child ought not be in a school room more than three hours a day. Let him be out of doors learning, as we have, the most and best of all we know. This can be, must be done in the city as well as in the country. The city school building must be located in a field where we can have such possibilities of out door education in the garden."

Miss Anna B. Comstock (N. Y.): "In regard to our publication I believe we are coming closer and closer to the teacher. In the public schools there are fifty teachers who are not trained in nature-study to one who has had training. We need to help these untrained teachers if we are to extend our work.

"I believe in the garden as an instrument of nature study. Gardening is not necessarily nature study. Much of the children's gardening that I have seen has had as little relation with nature-study almost as did their manual training. We must realize that in the garden the child is handling live material and we should utilize it as such."

M. Louise Green (N. Y.) pleaded for the garden as a means of giving the child notions of civic and social rights.

Louise Klein Miller (Ohio) reported the erection in Cleveland of a new high school which is equipped for a course in agriculture, horticulture and landscape gardening.

In discussing the relation of nature study to elementary agriculture D. J. Crosby (Washington) said in part: "Nature-study has lacked purpose and definiteness. It has failed to reach

a goal. Elementary agriculture, on the other hand, has been too bookish. It has lacked the nature touch. The two subjects, I believe, are interdependent. Nature is best studied in connection with some problem in which the child is interested. The potato beetle is best studied in a potato patch but best of all in *my* potato patch."

In this connection the following excerpt from a letter to the President from L. H. Bailey (N. Y.) will be of interest: "I feel that the agricultural phase of nature-study should be more emphasized, not because of agriculture but because the nature-study idea is fundamental to educational processes and the development of rural education is to be one of the great problems of the immediate future.

"I should feel that the Nature-Study Society should be distinct and should have its own separate work and existence. I should dislike to see it amalgamated with other organizations, even though its membership were never large. I think that the nature-study idea should be prominently maintained. However, if some sort of an informal association could be had with the school-garden people, and with others, it ought to strengthen all sides of the work. Possibly the two organizations could meet, following each other, in the same place.

"I have never cared for very large numbers in the membership of the American Nature-Study Society. I am interested in seeing the work grow and in letting the membership grow gradually as the idea takes hold. I think that more will be accomplished in the end by having a rather definite membership that represents real workers than to have a very large membership that represents those who are only casually interested in the subject. Of course, I should try to include as many teachers as possible; but I think that the basis of membership should be the fact that such teachers are really workers in nature-study lines."

The following extract is from a similar letter from J. Dearness (Ont.):

"I am one of those who think that not much agriculture that is 'worth while' can be taught in the public school grades that cannot be taught by the nature-study method and that the nature-study work in rural and all other schools should be conditioned on environment and the more or less familiar experiences of the pupils. It follows that in an agricultural community much or nearly all of the nature-study work would be agricultural or be of interest to agriculturists. Gardens at schools and

at home, barns and fields and kitchens are the nature-study laboratories where the children observe and even exepriment.

"From my point of view alliance and co-operation between a Nature-Study Society and a Garden Association would be natural—should be mutually beneficial."

At the Thursday morning session E. R. Jackson of the Forestry Department, Washington, discussed Forestry and Nature-Study.

Forestry seems perhaps a little out of touch with nature-study. We can hardly teach nature-study without teaching agriculture and gardening. When we come to forestry it seems as if we were dealing with a professional subject. Yet the gist of Modern Education seems to be to put the child in touch with the things immediately about him. Most teachers use the trees in nature-study work. Why not go a step farther and study the forest! First, teach the child to know the trees just as he knows his friends. Do not expect him to relish learning them by means of a key any more than you would enjoy the attempt to recognize your friends by a description based on the Bertillion System. So lead on to the forest. It contributes to our comfort with food, furniture, houses. It protects and enriches the soil, it regulates water flow and so enters as a prominent factor in our daily lives. He called attention to Farmers Bulletin No. 468 just issued, Forestry as Nature-Study.

Mr. F. B. Dressler and W. S. Small made clear that many of the topics considered in nature-study may have a bearing on health instruction. Thus if we teach well that warm air rises and cold air flows in to take its place we establish the foundation for practical ventilation. The average individual has yet not learned the fact well enough to really use it. Along with insect studies we should teach their role as disease carriers and the imperative need of extermination. Havana has not had a case of yellow fever in four years because some effective nature-study work was done and applied.

The problem of sex hygiene has its solution in nature-study as far as biologic instruction can solve it. We must remember that there are industrial, social, moral conditions involved in this, however, so that the knowledge of normal functions is only one factor, even if an important one.

C. F. Hodge (Mass.) spoke on the Civic Relations of Nature-Study somewhat as follows:

"All the great topics so far discussed in our program have their vital civic elements and relations. When we study them

from this point of view I think you will agree that these civic elements are the most vitalizing, organizing and unifying in the whole round problem of nature-study. We may call this aspect of the science Civic Biology, and under this head we include all the problems to solve which requires co-operation of the members of a community.

"We may represent the entire scope of our biological education as a series of enclosed spheres of interest. In my own mind these are all delimited by the natural mental growth of the child. In the center we have the period of infancy—the three or five years before school life of any sort begins. This is the most vital period of all—the years in which the child learns more real things than in the next thirty. Around this central sphere form a series of concentric spheres representing the life of the child in the home and public school. Here are the nature-study years proper and the dominating interests are the vital needs of the child in the home; and home life is the civic heart of all national life. These spheres naturally enlarge, we can put in more matter, as the child develops from grade to grade and civic elements increase as the child develops relations with the life of the community in which he lives. Then as the child grows toward active *citizenship*, we should make the course in the high school practically pure *civic biology*. So much for the general scheme now for the civic elements involved.

"'Hygiene'—conservation of national health and efficiency, gives us a money saving of from two to four billion annually with all the preventable sickness, with the misery and premature death involved. Here we need intelligent cleanliness, practical knowledge of germ infections, and their prevention, control of mosquitoes and the even much more imported civic problem, that of the typhoid or filth-disease fly.

"The 'Forestry' we ought to be co-operating as a nation to conserve the forestal reserves of the country. The roots of this whole problem are down in those nature-study years.

"Elementary agriculture and gardening are absolutely fundamental to the development of a sense of property rights. We see this in the typical tenement city, where no one can own a private fruit, flower or vegetable garden without having anything destroyed by vandals. We cannot blame the boys and girls for this. The fault lies in this iniquitous tenement-house system. Every human home should be on the earth with a garden. The resources of living nature stand ready to make the land a paradise as soon as we can learn enough to unite in effective

effort to utilize and control them. We must look to biological education in these civic elements of nature-study to build the foundations on which society may unite in effective civic efforts."

The committee appointed to investigate the teaching of nature-study in the Normal schools, Mr. C. H. Robison, chairman, reported progress.

A motion prevailed that it be the sense of the Association that an affiliation be made with the Garden Association of America and that the Council be so instructed (this was later accomplished and announcement of results is made elsewhere).

The reports of the President and Secretary were most encouraging showing the largest membership yet achieved and the best financial condition. The President besought the active co-operation of all to take advantage of this condition and secure a sufficiently large membership to put the Society in a place of commanding influence in Nature-Study and affiliated lines and to provide the necessary income to improve the Review so it may meet the increasing demands.

The election of officers for 1912 resulted as follows:

President—Benjamin M. Davis (Ohio).

Vice Presidents—S. Coulter (Ind.), D. J. Crosby (D. C.), F. L. Holtz (N. Y.), M. A. Bigelow (N. Y.), Anna B. Comstock (N. Y.).

Directors—C. F. Hodge (Mass.), L. H. Bailey (N. Y.), Laura E. Woodward (N. J.), S. C. Schmucker (Penn.), H. H. Cummings (Utah), E. E. Balcomb, 1 yr. (N. C.). The following hold over for another year or until their successors are elected in case of those representing local centers: Ruth Marshall (Ill.), E. E. Babcock (Cal.), J. Dearness (Ont.), Otis W. Caldwell (Ill.), J. A. Drushel (St. Louis section), Grant Smith (Chicago section).

Field Work of St. Louis Section, American Nature-Study Society

J. Andrew Drushel.

Harris Teachers College, St. Louis, Mo.

The constitution of the local center provides for a specified number of field trips. The chief purposes of the field work among our members are (1) to become better acquainted with the local physiography and fauna, (2) to secure material for class use, much of which becomes the nucleus of a school or room collection, (3) to stimulate the children to become acquainted with our local plants and animals through the renewed interest of their teachers in this work, (4) to encourage the members to carry their work beyond the mere naming of plants and animals, (5) to cultivate the habit of field observation preliminary to making some original contribution to science, (6) to promote sociability and good feeling among those people who wish to study nature in the field. The constitution provides for at least four excursions during the year, two in the spring and two in the autumn. Since the organization of the local center there have been conducted under the auspices of the local body six field trips yearly. This is in addition to the trips made by small groups of members upon their own initiative.

We have always regarded it necessary for competent persons to make, prior to each excursion, a survey of the region to be studied. Then a synopsis of this region is made by the preliminary survey party—the local executive committee consisting of the president, the director, the secretary, and two other members chosen from the section—and one copy is sent to each member of the section a few days before the excursion. Those desiring to make the trip are, thereby, entitled to make a preliminary study of the points to be investigated. All this requires considerable time and effort; but, as a compensation, the members have come to consider the synopsis a necessary part of the equipment of a successful trip.

The following synopsis was used for the Allenton (Missouri) trip which gave special attention to the plants of that region.

The third spring field meet of the St. Louis Section of the American Nature-Study Society will be held at Allenton Missouri, Saturday, May 6, 1910. The members will leave Union Station on the 9:25 Frisco train, or Tower Grove at 9:34.

Ten-trip party tickets costing $3.70 each may be purchased at the

Frisco city office, at Union Station, or at Tower Grove. One round trip fare is $1.48. It is suggested that those going associate themselves in groups of five, thus securing the benefit of the party rate.

The region to be studied is Fox Creek, one mile west of Allenton, reached by a good road. Much of value can be learned on the way. Returning, the members may leave Allenton at 4:24 or 4:47, arriving at St. Louis at 6:10 or 6:15.

The members should endeavor to make the acquaintance of the following plants: Dragon root, Jack-in-the-pulpit, camassia, commelina, spiderwort, cypripedium, hypoxis, iris, Solomon's seal, 3 trilliums, 2 bellworts, amsonia, columbine, wild ginger, astragalus, several Indian plantains, 3 hickories, hackberry, 2 dogwoods, shooting star, white ash, blue ash, geranium, alum root, green violet, water leaf, black walnut, butternut, puccoon, monarda white and purple oxalis, penstemon, several species of phlox, may apple, potentilla, buttercups, sassafras, golden ragwort, red elm, birdfoot, violet.

For help on plants consult Messrs. Letterman, Dougan, Hard and Drushel, and Misses Plass, Wade, Hintze, and Rice. Messrs. Brown and Sexton can help us with the trees. For geography see Messrs. Gill and Stevens. Mr. Christie has charge of the birds. Mr. Noel will aid us along the insect line.

On account of the many attractions offered by the Allenton region,

A Portion of the St. Louis Section Studying Glacial Drifts near the Chain of Rocks, St. Louis.—The Bluff Consists of Drift and Loess on Top.—Oct. 14, 1911.

this trip should be the most valuable one of this season. Mr. Letterman has kindly offered to pilot our party for the day.

Rare wild flowers should not be pulled, nor should living twigs be broken. If necessary, they may be cut. Breaking branches is always harmful to the tree or shrub; cutting them may be beneficial. Do you see why?

The trip outlined above, a three-mile walk, was made by 110 members, nearly all nature lovers. The number attending varies from 20 to 120, depending upon the season, the length of the walk, the topics for study, the attractions offered for that particular Saturday in the city.

Having arrived at the field, the party divides itself on the basis of topics to be studied. Among the members of the section are individuals who have a fair working knowledge in one or two of the following lines: physiography, geology, systematic botany, mushrooms, trees, birds, and insects. Those having common interests naturally seek out the one who can help them. In this way the party, if it be a large one, is broken into six or eight groups. The official photographer, Miss Crecelius, busies her-

Outcrop of Kimmswick Limestone at Fox Creek, Thirty Miles Southwest of St. Louis.—May 6, 1911.

LUNCHING AT THE MOUTH OF CLIFF CAVE, SOUTH OF ST. LOUIS.—MARCH 21, 1910.

self with taking suggestive views which later are made into lantern slides and add to the value of the later discussions that center on the trip.

The value of the field work may best be expressed in the opinions of certain teachers and principals who are members of the section. One teacher writes as follows: "The field trips which we have taken have benefited me mostly by increasing my knowledge of plants and of the topography of our neighborhood. Through these trips I visited districts which I would otherwise never have seen, and noticed in places which I had visited before, things of interest, chiefly topographic, that I had passed by. My observations have somewhat enlarged the basis on which I build my lessons. They have supplemented class work and made real many things which I have read." Another teacher summarizes the value of this work to her as follows: "Material for class room use was gathered. Much benefit has been gained through outdoor exercise and through pleasant companionship. New concepts have been acquired. Vague concepts have been made clear, and

clear concepts have been made lasting." A principal from one of the large schools of the city speaking for his teachers says: "We feel that the excursions have made us much better acquainted with one another and with the physical geography and botany of the region around St. Louis." Another principal from one of the large West End schools writes: "As nearly as I can determine I think the field trips of the Nature-Study Society have caused a better realization of the wealth of material at hand both for nature-study and geography work. There is a tendency to rely more upon materials obtained "first hand" for illustration and study than to rely upon museum material or upon books."

Seed Testing

W. L. Oswald.

Instructor in Agricultural Botany, Agricultural Colloge, University of Michigan.

An increasing stress is being placed on Nature study in both our rural and graded schools. This work has proved very interesting as well as helpful. It awakens interest and stimulates a love for Nature, and above all it furnishes a most valuable training in the powers of observation. Nature study, if properly presented, leads the students to see that all knowledge does not lie in books, but that much can be obtained by merely observing the things that lie close about them. Just as Nature is many sided, so a study of Nature bears innumerable aspects.

All phases of Nature study may contribute to the powers of observation, but not all awaken the same amount of interest. A Nature study subject need not necessarily be impractical. Many possible lessons in the study of Nature are overlooked because of their nearness to common every day life. The tendency in Nature study is too often to wander from the paths of the ordinary and to seek only the unusual and remote. The fields and woods are unquestionably interesting and proper sources of Nature study, but the towns and cities and home are not devoid of abundant material. They furnish, moreover, material which the student calls practical, that is, which bears promise of immediate usefulness. Such objects of Nature study tend to

arouse interest in many students and perhaps more particularly the boys, when the aesthetic lure of the meadow or forest fails to attract.

Such a subject is the study of seeds, and one of the most interest stimulating phases of this large subject is that of seed testing.

The subject of "Seed Testing" is a phase of Nature work which can easily be presented in rural, graded and high schools. It is admirably adapted for practical exercise work in schools since it can be easily carried on at any season of the year, and the cost of apparatus or working material is little or nothing. If this subject is presented properly it will create much interest and will at the same time be both instructive and practical. It will lead, moreover, to increased interest for the student in the study of field crops, the identification of weed seeds, especially as found in commercial seed, in the study of weeds and their relation to farm and garden crops, in the physiological and ecological features of seeds, and finally it is most excellent material for training in keenness of observation in detecting minute differences in seed structures. The importance of seed testing is readily seen in the enormous annual loss caused by weeds.

Weeds are brought onto the farm in many ways; by wind, by birds and animals, by water, by machinery; but one of the most important methods is the sowing of impure seed. Crop seeds are often very badly mixed with weed seeds as well as with chaff and dirt. This condition most frequently is brought about by carelessness in threshing and cleaning the harvest. Nevertheless, the impurities are sometimes not only not accidental, but they may be intentional adulterations. Unscrupulous

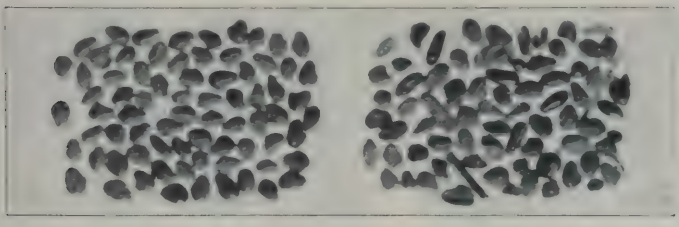

Fig. 1 Fig. 2.

FIG. 1. PURE RED CLOVER SEED.

FIG. 2. RED CLOVER SEED MIXED WITH DIRT AND WEED SEED.

seed dealers in their search for increase or profit sometimes adulterate their good seeds with seeds of inferior quality. They may also add to their commercial seed weed seeds which on account of their similarity to the commercial crop seeds are not detected by the average buyer. Alfalfa and clover, for instance, are sometimes adulterated with the seed of sweet clover and yellow trefoil. Unless one knows the differences between these seeds it is impossible to detect this adulteration. It is even possible, though rarely perhaps, to find in commerce evident adulterations in which weed seeds quite different from the crop seed are added—a fact which quite clearly shows that the average buyer of seed has not developed the power of an observer of differences. Of course honest seed dealers refrain from such practices. It can be readily seen then that every person who buys seeds ought to be as familiar with the weed seeds as he is with the seeds of the crops he wishes to sow. One of the first steps towards profitable agriculture is the sowing of pure seed. Furthermore, before planting seed one ought to know not only what weed seeds and how much dirt and chaff are present, but also what percentage of the seed will grow when planted. Seed may be pure, but at the same time may also be poor in vitality

FIG. 3. WEED SEED CASE PREPARED BY SEED LABORATORY, MINNESOTA AGRICULTURAL EXPERIMENT STATION.

FIG. 4. TRIPOD LENS AND FORCEPS USED IN MAKING PURITY TESTS.

or power of germination. In order, therefore, to get a correct knowledge of seed to be planted both purity and germination tests are necessary.

It will be the object of this paper to show how both purity and germination tests can be made in schools or at home without the use of expensive apparatus.—a Nature study lesson at once interesting, instructive and practically profitable. In making a purity test one needs to have a knowledge of the different weed seeds. The best way to recognize weed seeds is to have samples of them with which to compare the unknown seeds. These seed samples may be collected by the students and then with the aid of the instructor correctly named and labelled. Samples may also be obtained in sets from Experiment Station and from the Seed Laboratory at Washington, D. C. A convenient form of seed case is shown in the accompaning figure. On account of the fact that a collection is so essential in this work and since the case figured is so easily prepared a description of its manufacture will be given.

This seed case has been devised at the Minnesota Agricultural Experiment Station. It can be easily and cheaply duplicated by the average student, as it is very simple in construction. It requires two pieces of glass, one piece of fairly thick card board and one of white bristol board, all 5x7 inches in size. Twenty-four holes or pockets are cut in the cardboard. These can be easily cut with a No. 12 gun-wad punch, or can even be made with an ordinary brace and bit, using a ¾-inch bit. The holes should be bored only half through the card-

board and then completed from the other side. This assures a smooth edge. After the holes are punched the white bristol board should be pasted on one side of the card, making the twenty-four pockets for the seeds. The names of the seeds to be put into the case should then be written or printed under each pocket and the seeds placed in them. Then a glass should be placed on each side and passepartouted with a $\frac{3}{8}$-inch cloth tape. If this work is done carefully the result will more than repay the time of the making. This collection of weed seeds is used in making purity tests; other cases with additional kinds of seeds for other purposes can also be made. Flower seeds, vegetable seeds and tree seeds, except very large ones, can be put into cases of this sort.

It adds greatly to the value of the work if the students collect their own seeds, which can then be accurately determined under the direction of the instructor. While collecting the weed seed the student becomes familiar with many weeds and to some extent learns their habits. It is these plants near at hand that are most often neglected, though they furnish the most interesting material for study. In making a purity test it is also necessary to have a lens, preferably a tripod, and a pair of forceps, and where a more thorough test is to be made a fairly accurate pair of weighing scales is necessary. A purity test should disclose the following facts:

FIG. 5. SECOND DIVISION OF TRIAL SAMPLE.

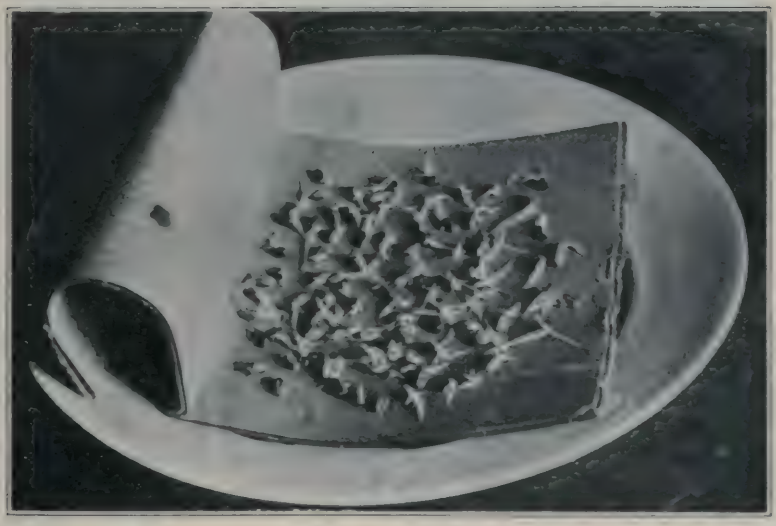

FIG. 6. GERMINATING WHEAT AT THE END OF THIRD DAY.

1. Percentage of pure seed.
2. Percentage of dirt, chaff, etc.
3. Percentage of weed and other seeds.
4. Kinds of weed seeds.

In making a purity test care should be taken first of all to get a good average sample of the seed which is to be tested. The seed must first be thoroughly mixed; then a sample of about a large handful should be taken for a test. This sample may be called a trial sample. After the trial sample has been obtained it should be placed on a flat surface, and then with a strip of tin or thin board it should be cut into two equal parts. If it is still too large it can again be divided, and so on until a sample of the right size is obtained. This sample may be called the test sample. The size of the test sample varies in different seeds. For instance, a test sample of red clover should weigh approximately $\frac{1}{25}$th of an ounce, while one of wheat should weigh about one ounce. After the test sample is obtained it should be divided into three piles: 1st, pure seed; 2nd, weed and other seeds; 3rd, dirt, chaff, etc. These divisions can be made with the aid of the forceps. In case no scales are available the percentage of each pile can be estimated, but if such scales can be obtained the percentage can be accurately worked out. After this is done the weed seeds are compared with the seed

collection and identified, thus disclosing the nature of the foreign seeds in the sample. This, then, completes the purity test.

The test for germination may now be made. A seed needs proper conditions of heat, air and moisture for germination. Different seeds require different conditions for best results. For instance, large seeds, such as beans and peas, germinate best between folds of moist canton flannel. Smaller seeds, such as wheat, oats, and red clover germinate best between folds of moist blotting paper, while very small seeds, such as timothy, alsike, clover and red top germinate most successfully on top of moist blotting paper.

It has been found that some seeds germinate best when variable temperatures are employed, but when a home germination test is made the ordinary living room temperature of 68° to 70° F. may be used. In order to make the germination test, two lots of one hundred seeds each should be counted from the pure seeds after the purity test is completed. Each lot is then placed either between the blotting paper or cloth or on top of the blotting paper, according to the seeds to be tested. Two tests of each sample are made to insure more accurate and average results. After the seeds are in place ready for the tests, the blotters or cloths should be placed between two ordi-

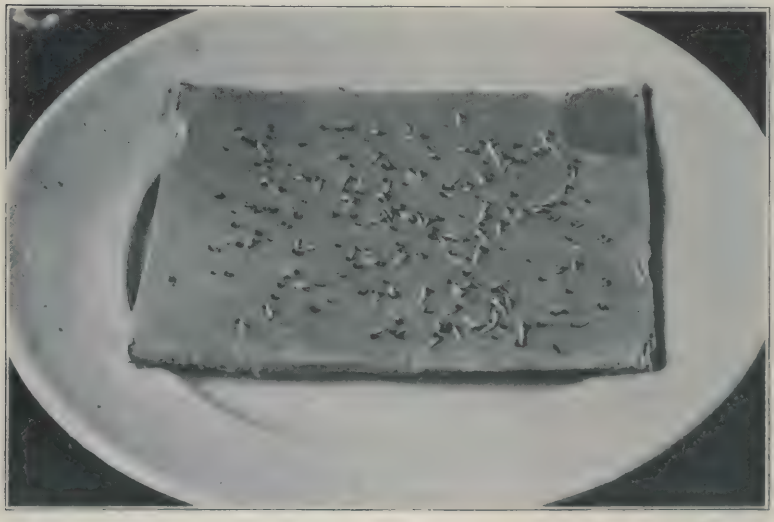

FIG. 7. GERMINATING ALSIKE CLOVER AT THE END OF THIRD DAY.

FIG. 9. GERMINATING BOX USED IN INDIVIDUAL-EAR GERMINATION TESTS OF CORN.

nary dinner plates. These should be kept in a room that is maintained at a temperature of about 68° to 70° Fahr. It takes six days to complete a germination test of most ordinary seeds. Some seeds, however, require a much longer time. The sprouts should be counted at least twice during the test and discarded at each count. The first count is made about three days after the test is started, and the final count at the end of the sixth day, when the total percentage of germination can easily be computed.

The individual-ear method should be used in a germination test of seed-corn. Sometimes, on account of improper curing, handling or storing, it happens that every seed on the entire ear will not germinate, and, when one stops to consider that it takes only sixteen to twenty ears to plant an acre, the importance of each ear is readily appreciated.

The individual-ear test may be made in different ways, according to the preference of the person making the test. Soil, sand, sawdust or moistened cloths may be used.

The individual-ear-test method requires two pieces of apparatus: (1) a rack, or other device, to hold the ears to be tested, and

FIG. 8. RACK FOR HOLDING EARS OF CORN TO BE TESTED.

(2) a box for the testing. The rack may be made from a piece of pine about four inches square, cut to an octagon giving eight sides for storage, and of a convenient height, supported on a broad base, so that it will stand upright. Then, on all sides 8d finishing nails are driven in, slanting upward slightly, and far enough apart to hold the ears of corn. Each nail is then numbered, and the butts of the ears which are to be tested are driven onto the nails. A rack with shelves may also be used if more convenient. A rack of suitable size is one that is about four feet wide and six feet high. The shelves are made of six inch boards and are placed three inches apart. Nails are then driven into the shelves, so that they partition each shelf into three inch spaces. These spaces are then numbered, and the corn to be tested is placed in the numbered spaces. Ears may also be hung by the double string method, or placed side by side on planks, the ears separated by nails.

A germination-box of convenient size is one that is twenty-two inches to twenty-four inches square, and four inches deep. A box of this size will test easily one hundred ears. Before making the test, the box should be filled with moist sand or sawdust, to within $1\frac{1}{2}$ inches of the top. Then a moistened cloth, canton flannel preferred, is placed over the wet sawdust. This cloth however, should first be marked off into two inch squares. The

ordinary "lead" pencil should be used in marking these squares, as ink marks will blur when the cloths are wet. The squares should be numbered to correspond to the numbers on the rack. When all is in readiness for the test ten kernels should be taken from different parts of ear No. 1 (butt and tip kernels should not be used) and placed on square No. 1, and so on until each square is filled. Then a moist cloth should be laid over the seeds, and the box placed in a room where the temperature is about 60° to 70° Fahr. If moist sand or sawdust is scattered over the top of the cloth it will not dry out so easily. At the end of the sixth day the top cloth may be removed by rolling carefully back, and the germination results noted. The ears, then, of which the seeds did not germinate at all, or that germinated poorly, should be discarded and only those with good germination (at least nine of the ten kernels germinating strongly) used for seeding purposes. Be sure to discard ears the seeds of which produce only poor sprouts. During the germination test if moist sand or sawdust has not been scattered over the top the top cloth should be carefully watched, and kept moistened. Do not, however, keep the cloths too wet.

Before the final shelling of seed-corn, the "butt" and "tip" kernels should be removed. No planter can plant uniformly when the kernels are irregular in size.

This, then, briefly indicates a simple method of presenting the subject of seed testing in a manner which ought to arouse interest. An exercise like this has not only economic value, but it offers advantages in the training for close observation and accuracy of methods, which are not excelled in the possibilities of presentation of any other agricultural or botanical facts.

How Orchid Seeds Grow

GEO. D. FULLER.

The University of Chicago.

When the word "orchid" is spoken one is likely to think of some rare plant with flowers of strange, fantastic shape and bizarre coloring, which had its home in the jungles of tropical America or of far-off India, or came perchance from some lone island in the Pacific and now blooms occasionally in the conservatory of a millionaire. This would be a true conception,

but it would be only a small part of the picture, for even in the northern United States there are many orchids, not perhaps as grotesque but often quite as beautiful as the most costly varieties of the green house. During May and June the various lady's slippers open their pink and yellow flowers, then in the swamps the grass pink, the Arethusa and the little Calypso display the exquisite shades of rose and purple, while later in the summer there are spikes of white and purple and orange fringed-orchids, and latest of all in the moist fields the sweet scented little white lady's tresses spring up everywhere. Thus while orchids are not abundant they are not uncommon in our own woods and fields.

They are plants closely related to the lilies but possessing flowers of more complicated structure and usually of irregular form. In cool countries they grow in the soil, although even there some of them have very few roots. But in tropical lands they often fasten themselves to the branches of trees and allow their roots to hang exposed to the humid atmosphere, absorbing water from the almost daily rains. Plants growing thus upon others but getting no nourishment from them are termed "epiphytes." Orchids possess curious devices to ensure that their pollen shall be carried from flower to flower by the insects attracted by their bright colors and sweet odor. Their seeds are the smallest known and look like small grains of dark brown sand. Within a seed the future plant is packed away in embryo. In many seeds the embryo is well organized, showing seed leaves and a tiny stem with its terminal bud; within the covering of the orchid seed there is only a small rounded mass of cells with a minute projection at one end. There is usually no trace of seed leaves nor can the beginnings of a stem be seen.

How these seeds grow in their native haunts no one knew, and almost every attempt to germinate them in a garden or greenhouse resulted only in failure. The most skillful gardeners tried in vain to raise seedlings of their most beautiful varieties but not a seed would germinate. At rare intervals some fortunate man would succeed by sowing the seed near the parent plant, but until a very few years ago the causes of success or failure were shrouded in mystery, and many strange and mythical explanations were offered. Very recently, however, a French botanist has succeeded in discovering the secret and now orchid seeds are grown in the greenhouse with much greater success.

It has long been known that the roots of many, if not all, of these curious plants are infested with a minute fungus some-

thing like mould. Such fungi usually cause disease, but in the orchid they seem necessary for the life of the plant. In the varieties in which they are most abundant the roots are short and stout instead of being long and fibrous. This is particularly true of orchids growing as epiphytes, although it is not uncommon in our soil orchids. It would seem that the fungus and the orchids have lived together so long that a condition of mutual benefit and mutual dependence has developed.

Usually when seeds are properly moistened they require only the proper temperature and a supply of oxygen for respiration and they will germinate, but most orchid seeds need something more, and that is the fungus that grows within their roots. Sometimes this is present in the soil near the parent orchid, but at other times it seems necessary to sow the seeds in contact with the orchid roots. This French botanist isolated the fungus and grew it upon a jelly made from the orchid roots. He then planted his orchid seed. Some of the fungus was put alongside of part of the seed, and only those seeds furnished with fungi grew. First they swelled to many times their size and then developed a bud, leaves and root. The other seeds swelled to about twice their size and then remained unchanged for two years or until they decayed.

It is now possible to divide the orchids into three classes, according to their germination habits. The first class contains a few soil-growing orchids, whose seeds germinate in the usual manner but rather slowly. Then comes a large class whose seeds sometimes germinate without fungi, but that germinate more rapidly and attain a more vigorous development if these organisms are present. Finally there are many orchids whose seeds have entirely lost the power of independent growth and are entirely dependent upon the stimulus supplied by infesting fungi. The parasite has apparently quite ceased to be harmful and has become necessary for the health and for the very life of the orchid. Such close partnerships are seldom found in nature.

Some Observations on Bird Families

Dwight E. Minnich.

High School, Kenton, Ohio.

The study of bird life, as a part of the nature study work in our public schools, is, unfortunately, still neglected in many places. To whatever other causes this neglect may be attributed, it is at least partially due to the indifference of some teachers to the importance of this work. In view of this situation, the summer term at Miami University has, for several years past, offered a course in bird study, designed particularly to meet the needs of such teachers. Coming alike from country and town, the teachers, who enter this course, are frequently unfamiliar with many of the commoner phases of bird life. Hence, the work has been organized around a few of our most common birds, with the aim of giving the student easy recognition of these birds by sight and note, a few facts concerning their habitat and economical importance and some plans for encouraging and protecting them.

Of the several methods used in doing field work, none has proved more effective in furthering the purposes of this course or in stimulating interest, than relay studies of particular bird families.* Usually a nest containing young birds is studied, special attention being given to their feeding. As the name relay, implies, this sort of observation is carried on by persons working in turn, each hour of the day, from four in the morning until dark, being assigned to two members of the class. At the close of each hour, a new pair of observers is ready to take up the record where the others left off. Careful notes are kept with reference to the following points:

1. Time of each feeding of young.
2. Whether fed by male or female.
3. Kind and amount of food fed, if possible to determine.
4. Where procured, if under observation.
5. Times parents feed themselves.
6. Times waste material is taken from nest.
7. Any other incidents which may throw light on the life of young or adult bird.

The record, thus obtained, of a continuous day in the life

*Note.—For this excellent scheme of studying bird life the writer is indebted to Dr. C. F. Hodge, and to two most interesting articles, containing observations made according to this plan, which appeared in the Dec., 1906, and the Dec., 1907, issues of this magazine.

of some bird family, is, in itself, of much value. Furthermore, each student observer has gained a new insight into the life and character of some bird, which, merely seeing the bird on field trips, could not possibly have given.

The data, given in the four following sketches, were collected by members of classes, working according to the relay plan.

The subject of the first study, which was made on May 21, 1909, was a family of Downy Woodpeckers. The parents had not chosen a particularly attractive location for their nest. But the weedy, half-deserted, little orchard, with its friendless, old apple trees and low hedge fence, and the large, open, woods across the road, afforded food in abundance. The nest was located about twelve feet from the ground in a dead limb of one of these apple trees. How many young birds it contained, could not be ascertained. Neither could the age of the young be determined, but from the noise they made, it is safe to estimate them, at least halfgrown. Observations on the nest began at 4:00 A. M. and continued until 7:21 P. M. At no time, apparently, did the parents take any notice of their observers, but went about their family duties as if no one were present.

The young were first fed at 4:33 A. M. From this first feeding until the last, which occurred late in the evening, a period of about 14½ hours, the nestlings were fed on an average of every 6.9 minutes. Often the interval between trips was only a minute. The longest interval, which occurred just before dark, was 47 minutes, the longest prior to that, being 28 minutes. The parent birds visited the nest 124 times, 36 trips being made by the male, and 88 by the female. As in the following studies, several trips are here counted, when the bird visited the nest in the usual manner, and apparently fed, although, it was observed carrying no food. Dividing the day into four-hour periods, the period of greatest activity was from 1-4, when visits to the nest occurred on an average of every 4.9 minutes. Several times, the bird hunted for food on the larger limbs of the tree in which the nest was situated. Usually however, the bird, on leaving the nest, flew directly to the woods across the road. Consequently, the kind or amount of food, fed, could not be ascertained. Twelve times, during the day, refuse material was taking from the nest, the birds carrying it a short distance before dropping it. Three times during the day, the nest was visited by a Red-Headed Woodpecker, which paused long enough to peer in, before going on.

In this study of the Downy Woodpecker, the figures, obtained relative to feeding, furnish an excellent example of the economic value of this bird. Each of the 124 trips to the nest, probably represents the destruction of several insects, harmful to trees, or perhaps, the egg mass of some insect, which, if allowed to hatch, might do much damage. Yet, even this record takes into no account the insects eaten by the parent birds, during the day. Certainly, a little effort expended in attracting these useful birds, in greater numbers, about orchards, parks and lawns would lead to telling results on the trees thereabout.

Table showing Number and Frequency of Feeding of Young of Downy Woodpecker.

HOUR	NO. TRIPS BY MALE	NO. TRIPS BY FEMALE	NO. TRIPS BY BOTH	AVERAGE NO. OF MINUTES TO ONE TRIP
4 to 5	2	6	8	7½
5 to 6	3	6	9	6⅔
6 to 7	4	6	10	6
7 to 8	5	3	8	7½
8 to 9	2	4	6	10
9 to 10	4	5	9	6⅔
10 to 11	3	4	7	8⅐
11 to 12	1	6	7	8⅐
12 to 1	1	12	13	4⅘
1 to 2	1	11	12	5
2 to 3	4	5	9	6⅔
3 to 4	1	9	10	6
4 to 5	3	4	7	8⅐
5 to 6	1	4	5	12
6 to 7	1	3	4	15
TOTAL	36	88	124	6.9

By way of comparison with the data gathered on the Downy Woodpecker, it is interesting to have a day's record of a family of Red-Headed Woodpeckers. This nest was located in a hollow limb, which had been put upon a pole, in the writer's backyard, with the hope of attracting Bluebirds. The Bluebirds came late in April and began nesting. Early one morning, about a month later, a pair of Red-Headed Woodpeckers attacked them, and after several hours of hard fighting, completely routed them. The Woodpeckers then tore out the Bluebird nest, throwing the three young Bluebirds (almost fully grown) to the ground killing them. From that time, the Woodpeckers' possession of the hollow limb was undisputed. Here, they raised two broods. This relay study was made about ten days before the first brood left the nest. There were at least two young birds in the nest.

although there may have been more. Both parents assisted in feeding the young.

Table showing Number and Frequency of Feedings of Young of Red-Headed Woodpecker.

HOUR	NO. TRIPS BY BOTH	AVERAGE NO. OF MINUTES TO ONE TRIP
4 to 5	6	10
5 to 6	4	15
6 to 7	3	20
7 to 8	8	$7\frac{1}{2}$
8 to 9	5	12
9 to 10	9	$6\frac{2}{3}$
10 to 11	6	10
11 to 12	4	15
12 to 1	1	60
1 to 2	5	12
2 to 3	9	$6\frac{2}{3}$
3 to 4	3	20
4 to 5	7	$8\frac{4}{7}$
5 to 6	9	$6\frac{2}{3}$
6 to 7	3	20
TOTAL	82	—

The first feeding in the morning occurred at 4:09 and the last in the evening at 6:49. During the 14 hours and 40 minutes the young Woodpeckers were fed 82 times, or on an average of every 10.7 minutes. The longest interval between visits was 1 hour and 10 minutes, this occurring just at noon, from 11:29 until 12:39. Several times, however, the visits were only $\frac{1}{2}$ minute apart. The period of greatest activity was from 8-12, when the young were fed every 10 minutes. However, it is readily noticed that this is a little below the average for the entire day, which was 10.7 minutes. This means, that at no period was the number of visits to the nest markedly greater than at any other period, a thing which was not true in the observations on the Downy Woodpecker. Twenty times during the day, were the parents observed carrying waste material from the nest, this occurring at least once every hour, except from 5 to 6 in the morning and 3 to 4 in the afternoon. In a closed nest of this type, great care must be exercised by the parent birds to keep it in a sanitary condition. Although most of the food taken to the nest was obtained in the vicinity of the nest, which contains numerous trees, the parents were seldom under observation while procuring it. The food, as far as could be determined, consisted of insects, a few cherries from neighboring trees, and some bread and suet taken from a bird's lunch counter, at the house nearby.

Several times, large bettles were brought, and once, a large grasshopper. By far the greater percentage of all food, consisted of insects.

Perhaps the Red-Headed Woodpecker is liable to the accusation of fruit stealing. A little investigation, however, will usually show, that the few cherries, so much begrudged this bird, are but a slight compensation for its services as a destroyer of harmful insects.

Division of labor was practiced in the bird world, long before man knew of its advantages. Thus, while the family of woodpeckers care for the trunk and branches of trees, other groups of birds are caring for the smaller branches and the foliage, each particular group devoting its energies to the task to which long specialization has peculiarly adapted it. It was with the purpose of emphasizing this idea, that a study on the Brown Thrasher was assigned to a class after its work on the woodpeckers.

This Thrasher's nest was located on the edge of an extensive woods. A thick bush, about five feet high, covered profusely with a tangled wild grape vine, furnished a typical site for the nest of a Brown Thrasher. Although well concealed, an excellent view of the nest could be obtained from one side without disturbing, in any way, the surrounding vines and branches. Several days previous to the day for the relay study, the class, on a field trip, happened to pass this spot. In order that all might obtain a close look at the two young birds which the nest contained, the writer reached up and placed his hand on the edge of the nest, so as to tilt it slightly. Like a flash, one of the parent birds flew down, attacking the hand with beak and claw, by repeatedly flying at it. Not content with merely beginning an attack, the bird continued this performance for a minute or more, refusing to leave off its defense, until we went away.

When a few days later the students came to make their observations on the nest, however, the Thrasher paid little or no attention to them. When observations began at four o'clock in the morning, one of the parents, presumably the female, was on the nest. Ten minutes later, she left, returning to feed the young for apparently the first time, at 4:30, twenty minutes later. From this time both parent birds were busy until 7:01 in the evening when the last feeding for the day occurred. During this working day of about 14½ hours, the Thrashers visited their nest with food 90 times, or on an average of once every 9.6 minutes. It

is interesting to note that while the largest number of trips for one hour, 13, occurred between the hours of one and two, the number in the hour following this, drops to a single visit. It was a warm day in mid July, and this time was probably spent by the parents for rest and feeding themselves. Sometimes the trips to the nest were only a minute apart, the longest interval of 58 minutes occurring after the single trip between 2 and 3 o'clock. The nest was cleaned 14 times during the day or on an average of once every hour. The parent birds obtained most of the food very close to the nest. Hence, they were under observation practically all of the time. The greater part of the food was obtained from the ground, the remainder being procured from the trees and bushes close to the nest. Once a mulberry was fed to the young. With this single exception, the food was entirely of insects.

Since most of the insects consumed were probably injurious, it is certain that the greater part of the food of this Thrasher family, consisted of harmful insects. Because of this ability in destroying insects, the Brown Thrasher is an extremely valuable asset to every field or garden, the bordering thickets and hedgerows of which, may invite it.

Table showing Number and Frequency of Feedings of Young of Brown Thrasher.

HOUR	NO. TRIPS BY BOTH	AVERAGE NO. OF MINUTES TO ONE TRIP
4 to 5	1	60
5 to 6	4	15
6 to 7	3	20
7 to 8	4	15
8 to 9	6	10
9 to 10	9	$6\frac{2}{3}$
10 to 11	11	$5\frac{5}{11}$
11 to 12	7	$8\frac{4}{7}$
12 to 1	9	$6\frac{2}{3}$
1 to 2	13	$4\frac{8}{13}$
2 to 3	1	60
3 to 4	5	12
4 to 5	6	10
5 to 6	6	10
6 to 7	4	15
7 to 8	1	60
TOTAL	90	9.6

The concluding study, appearing here, is a study of the Wood Thrush. Although often thought of, as a bird frequenting

only the deep woods, this is by no means true of the Wood Thrush of the locality, where these observations were made. A quiet college town with its shaded streets and lawns and a well wooded campus, seems to have attracted the Wood Thrush in numbers. And they are to be found nesting in the trees about this quite as frequently as on the campus, itself.

The particular nest which came under our study, was located in the top of a small maple tree. It had been built about four weeks previous to the date of observation, which was June 8, 1907; so the young birds must have been from twelve to fourteen days old. Except a little annoyance at first, the birds paid no attention to their observers.

Table Showing Number and Frequency of Feedings of Young of Wood Thrush.

HOUR	NO. TRIPS BY BOTH	AVERAGE NO. OF MINUTES TO ONE TRIP
4 to 5	8	7½
5 to 6	12	5
6 to 7	13	4 8/13
7 to 8	8	7½
8 to 9	11	5 5/11
9 to 10	10	6
10 to 11	7	8 4/7
11 to 12	5	12
12 to 1	7	8 4/7
1 to 2	7	8 4/7
2 to 3	12	5
3 to 4	8	7½
4 to 5	5	12
5 to 6	6	10
TOTAL	119	6.8

The first feeding trip to the nest was made at 4:10 in the morning. From this time until 5:40 in the evening, the time of the last feeding, 119 visits were made to the nest, or on an average of one every 6.8 minutes. The period of greatest activity was from 4 until 8 in the morning, when the interval between trips averaged 5.8 minutes. The longest period between trips was 34 minutes, this occurring late in the evening, however. Frequently the intervals between trips was only a minute. Fifteen times during the day, were parents observed feeding themselves. The female bathed early in the morning and again early in the afternoon. The male took his bath shortly after the female had bathed in the morning. The parent birds procured most of their food in the grass or at the side of the road, close by. No

instance was observed of catching insects on the wing, nor were the parent birds observed taking food from the trees or shrubs near by. The food seemed to consist mainly of earth worms and larvae of insects. Occasionally, the birds brought black objects to the nest, which were very probably beetles.

So the Wood Thrush, too, must be classed as economically important in destroying our insect enemies. As many as three objects were observed to be brought to the nest at a single feeding. It is easy to see what a potential check such a bird family as this is, upon the increase of injurious insects of a locality. Yet, here, a single day in the history of a single bird family, only, is recorded.

So, with each of these studies, but a single day in the life of a single bird family is told. Day by day these birds go unobserved about their work, destroying noxious insects, consuming weed seed, thus, helping to maintain the balance of life in the great natural scheme of things, and make the world more habitable. But many are the factors at work today, to decrease the bird population, and as it decreases, trouble with insect pests is certain to increase. A wider protection must be afforded our birds. The spirit of protection can best be taught through the public schools. And if the teachers, who gathered these data, have been deeply enough impressed with their economic significance, so that they will go back to their schools and teach a more intelligent protection and encouragement of bird life, at least something will have been accomplished toward securing an increased protection for our birds.

Pigeons

LEON J. COLE.

One who has visited a poultry show where pigeons are exhibited, must have been struck by the great variety of form, feather and color pattern displayed in the different breeds of these birds. There is probably no other kind of domestic animal which shows such a diversity unless it be the dog, which now includes a great range of structural modifications. But whereas the dog is supposed to have had a multiple origin from several more or less closely related wild species, all the forms of domesticated pigeons are commonly believed to be descended from a single wild progenitor,—the wild Rock Pigeon, which is still to be found on certain of the remote islands of the North British coast.

PIGEON HOUSE AND FLIES, DEPARTMENT OF EXPERIMENTAL BREEDING, UNIVERSITY OF WISCONSIN.

And when the pigeon becomes half wild again, as it is in many of our cities, nesting in the corners and cornices of our buildings, and breeding unrestricted, there seems to be a tendency for it to revert in color and form to its truly wild ancestor. Indeed many of the pigeons of our streets and parks, which are blue or blue-checked with black wing bars, a light rump and red eyes, could scarcely be distinguished from the Rock Pigeon.

Most people who keep pigeons, house them in a "loft," as a pigeon house is usually styled, whether it be on the roof or on the ground, and either let them fly at large or in a screened "fly." There is considerable danger, however, in allowing valuable birds to fly at large, since they are liable to be stolen or shot or in some way lost. They will do well moreover in comparatively small quarters if properly cared for. They should be kept in a light, well ventilated place, and if the birds are to remain in good health, it is important that they should be kept clean. In their food, variety is of importance. The small round peas known as Canadian field peas with Kaffir corn and wheat, form a good basis to which may be added cracked corn, millet, rice, and hemp seed. It will be necessary to vary the proportions of these grains. Green food such as lettuce or cabbage will be appreciated and may at times be fed to advantage. It is best to feed twice daily at regular intervals, and to give at each feeding

only as much grain as the birds will eat up clean. It is well to furnish a supply of charcoal, in small pieces, salt, and some sort of grit. If sand is used to cover the floor, or if they have access to other clean sand, the grit will not be necessary. Fresh water is of prime importance. The water should not be given in an open dish, but should be protected to prevent its becoming foul. A small size of the ordinary poultry fountain makes a very good watering dish for pigeons. Fresh water in a large open dish should be supplied daily for the bath, but should be emptied immediately after the birds are through bathing, in order to prevent their drinking this water.

Hemp seed should be fed sparingly. Pigeons love hemp seed as children love candy, and it is very useful for taming them. If one will carry a supply of hemp seed in one's pocket and offer the birds a little each time he goes into the pen, they will soon become very tame and will come and alight on one's hand at call.

There are no external marks by which the sexes of pigeons can be distinguished; but the male can often be told by his behavior, especially at certain seasons when he shows a disposition to strut about and to fight upon the least provocation. When the

Fig. 2. WHITE JACOBUS.

Fig. 1. Owl.

birds become mated, they remain so permanently if disturbing factors, such as the presence of a surplus of unmated males, are kept away. The birds will breed the year around, but it is best to separate the sexes during the winter months, since it is very difficult to raise squabs during the cold weather. If the birds leave the eggs for a few moments, the eggs become cold, or if there are squabs they are apt to freeze. Even if they do not die outright, they often contract "colds" or "canker" and die after lingering on for a considerable period. Furthermore, there is much more danger of sickness among the old birds if they are allowed to breed during the cold weather. If the pigeons are kept in a warm place, however, they could probably be bred the year around without difficulty.

There is a variety of ways in which the nest boxes may be constructed, but the essential is to have some place that may be easily cleaned. Often two boxes are arranged so that they open from a single entrance. Since a new complement of eggs is often laid before the previous squabs are ready to leave the nest, and th thus two nests are in use at once by the same pair of birds, earthen ware nest pans or "nappies" are commonly placed in the nest boxes and tobacco stems or straw provided for the nest, which the birds themselves build.

Fig. 3. White Fantail.

Only two eggs are laid and these at an interval of about forty-five hours—the first usually between four and six in the afternoon and the second about one and two o'clock in the afternoon of the second day following. Both birds take part in incubation, the male taking his turn on the nest from about ten o'clock in the morning until the middle

of the afternoon, when the female resumes her responsibilities until the next morning. The eggs hatch in about seventeen days. The idea is prevalent among pigeon breeders, that the first egg laid produces a male and the second a female. This, however, is not true; it is an equal chance whether either egg will produce a male or a female, or whether they will be both of the same sex. The young squabs, when first hatched, are covered only sparsely with yellow down, do not have their eyes open and are entirely helpless. They are fed by both parents. The little bird puts its bill within that of its parent who then regurgitates a secretion from its crop known as "pigeon's milk." After the squabs become older, however, they are fed on the grain which has been softened to some extent in the crop of the parent. The young birds usually remain in the nest for nearly a month, or until they are well feathered and able to fly to a greater or less extent. They are fed by the parents, however, for a considerable time after leaving the nest. During this stage, they are importunate for food and follow their parents about with beseeching cries, and for this reason the name "squealer" is often applied to the squab at this age.

Fig. 4. A Carrier Pigeon.

Fig. 5. Flying Homer, Racer with 500-Mile Record.

Only a few of the breeds and their characteristics can be mentioned in an article of this length. The difference in size in pigeons is not so marked as in some of the other domesticated animals, though small breeds, like the Short-faced Tumbler, are considerably smaller than the average, while one of the largest breeds is as large as a bantam, and is rather facetiously known as a Runt. In the matter of feathering there is great variety, as seen in the frills

Fig. 6. English Pouter.

on the necks of *Turbits*, Owls (Fig. 1), and similar breeds, the crests of the Nuns, Turbits, and others, and in the hood of the Trumpeter and *Jacobin* (Fig. 2). In the former case, the feathering reminds one of the Polish fowl, while in the second the hood forms a ruff around the head, which, in many cases, almost hides it from view. The Frill-back reminds one of the so-called Frizzled fowl, and is characteristized by the "conspicuous reverse growth of the feathers covering the shoulder coverts, all of which in graduating proportions appear as if they had been curled evenly with curling-tongs." In some breeds there is a heavy growth of feathers, three and one-half to four inches in length, on the legs and toes. This is spoken of as a "muff" and resembles the booted condition of certain breeds of fowls. It is especially well developed in the Muffed Tumblers. The great development of feathers in the tail of the *Fantail* (Fig. 3) pigeon is familiar to every one.

Among the variations in other structures may be mentioned the eyes, which are red in the wild form and in some of the domesticated ones, such as the Homer, which in many respects seems most closely related to the parent stock. In Tumblers the iris is white, while in the Owls and Turbits the eye is black. In the *Carrier* (Fig. 4) the eye wattle is greatly developed and the cere on the beak may be as large as a small walnut. The bill of the Scandaroon is enormously developed, while in the Short-faced Tumblers and Owls it is so short that they are unable to feed their young, and in order to raise these birds it is necessary to turn the young over to a pair of some better feeding breed, which may act as "nurses."

In habits also, there has been considerable differentiation. The *Homer* (Fig. 5), as the name implies, is remarkable for his homing instinct, that is, the ability to return to the home locality from a considerable distance, with certainty and in the briefest possible time. All pigeons in strutting about and cooing have the ability of distending the crop to a greater or less extent by forcing air into it. In the *Pouter* (Fig 6), this characteristic has

been developed to an extreme, and the birds are furthermore trained to inflate the crop and show off at the owner's command. Another curious habit is that of tumbling, which, as the name suggests, is developed in the Tumbler pigeon. This occurs in all degrees. In some birds it consists in turning one to two or three back somer-saults while they are flying high in the air, while others will tumble in the confines of an ordinary pigeon fly. Again there are those commonly called Parlor Tumblers, which are unable to fly at all, attempts at flight resulting in a back somersault. In others still this habit is carried to such an extreme that if the birds are the least bit excited, they will roll over and over backwards across the floor the distance of several feet. This habit suggests that of the Japanese dancing mouse, which continually runs about in circles. The attempt has been made to show in the case of the latter animal, that the habit is associated with a defective development of the semi-circular canals of the ear; but it seems fully as probable that in both instances these peculiar actions may be due to deficiencies in the central nervous system.

Finally, as to color, there is a great variety of patterns, but the same patterns or their elements are to be found recurring in many of the different breeds. The "self" or solid-colored pigeons may be white, black, dun, red or yellow. Blue and silver birds are self colored except that they have black wing bars, a black tip to the tail, and a lighter rump. There is no end of special patterns, but these differ from the patterns in fowls in that they largely involve *areas* rather than patterns of the individual feathers themselves, such as striped, spangled, barred, etc. Breeding for color in pigeons, is a fascinating pursuit and has for ages occupied a large share of the attention of the fancier. Nevertheless, the relations in inheritance of the different colors and color patterns is very poorly understood and offers a good field for scientific research.

Pigeons, furthermore, offer excellent material for students of animal habits and behavior. One who becomes familiar with them soon learns to recognize the different stages of the nesting cycle, and the influence of unusual conditions upon the regular development of instincts. In this respect, pigeons offer much better material than the polygamous poultry. Their life is largely one of activity, and much of it is devoted to love-making, the rearing of young, and fighting in defense of personal rights or simply to bully the other birds in the loft.

Breeders of pigeons mark their birds by means of some

kind of circlet or band of aluminum bearing the desired number. These can be slipped over the feet of the young squabs and, if of the proper size, will not come off. Such bands may be obtained from any of the regular poultry supply houses, such as the Excelsior Wire and Poultry Supply Company, 26 Vesey Street, New York City, or the Keyes-Davis Company, Battle Creek, Michigan.

To distinguish individual birds without having to catch them in order to read the numbers, temporary colored leg bands are of much use. A satisfactory kind is the Stevens band, manufactured by F. A. Marshall, 220 Bancroft Avenue, Reading, Massachusetts. To one who wishes to do breeding systematically, the matter of keeping the records is of great importance. A pamphlet entitled "Methods of Keeping Pedigree Records in use at the Rhode Island Agricultural Experiment Station," describes a scheme which has given much satisfaction with pigeons. This pamphlet will be sent upon application to the Director of the Rhode Island Experiment Station, Kingston, Rhode Island. Perhaps the best available general book on pigeons in the English language, is "Fulton's Book of Pigeons" published by Cassell & Company, London. For those who are interested in special breeds or in showing, there are numerous pigeon clubs in various parts of the country, and several pigeon papers, such as "Pigeons," Poultry Publishing Company, Peotone, Illinois, are published for those who are especially interested in the fancy.

A Method of Illustrating the Trees

J. E. Kirkwood.

University of Montana.

As an aid in the presentation of tree botany, or for museum purposes, the preparations described below have been found very satisfactory. Their cheapness and attractiveness in addition to their utility suggest that they may be generally helpful. Originally designed by the writer at the University of Montana for the University's exhibit at the State Fair, they have since been found of large practical value in the class-room, and their description is submitted herewith in order that teachers elsewhere may have the benefit of the suggestion.

Each preparation illustrates one species, and consists of a wall frame containing a card on which the illustrative material is mounted under glass. The outside measurement of the frame is 26½ by 32½ inches. For this purpose 1 by 3 inch lumber dressed down to ¾ by 2½ inches will make up well. The material may be pine or other clear stuff of good quality, and should be treated to two coats of Jap-a-lac of the desired color. A shade of medium oak does very well. The frames can be put up by a carpenter, or at any convenient factory at a very nominal cost. The frame thus constructed should take glass and card 22 by 28 inches, which is a standard size. The card used may be photographers' plain mount board of a dark gray color.

The materials which enter into the exhibit may be obtained at little cost. Some of them may be contributed by pupils as part of the work of the laboratory or field. The following is suggested as a useful list, but it may be modified in various ways:

1. A full-sized herbarium specimen of the species, showing leaves and flowers and fruit where practicable, mounted on good herbarium paper.

2. A seedling of the species. These may often be found without difficulty in the woods, or in some cases may easily be grown. They should be dried under pressure as in the case of herbarium specimens.

3. A map showing distribution. A convenient size is 9½ by 7 inches. I have used the outline maps of the United States, sold by the Cambridge Botanical Supply Company. With the margin removed these are about the right size. Upon such a map may be traced the approximate limits of distribution of a species within the United States, and the areas enclosed tinted with a wash of green water color.

4. A section of the wood. For this purpose the sections sold by Romeyn B. Hough of Lowville, N. Y., are the most satisfactory, and as the most important trees of the country are now represented in the series, and individual cards showing transverse, radial and longitudinal sections can be obtained at a nominal cost, most of the wood material required may easily be secured. The cards should be mounted entire.

5. Photographs. Space still remains for two pictures 5 by 7, or 6½ by 8½ inches. These may represent individual trees at close view, showing the character of the bark or other features, or a more distant view showing the typical form of the crown. It is often desirable to have a landscape scene depicting the habitat of the species. Most of the photographs desired may be obtained of the Forest Service at a small price.

6. A printed label giving the common and scientific name of the tree may be mounted at the bottom of the card.

After mounting the objects on the card it may be placed in the frame and held in position by two strips of corrugated board such as is often used in the backing of pictures. As this board may be obtained in 14 inch widths, two 22-inch lengths exactly fill the back of the frame, and may be held in place by small brads. Two screw-eyes set into the top of the frame serve best as a means of suspending it, either by picture wire, or by hooking the eyes over nails set in a strip of wood fastened to the wall.

The cost of one of these preparations, exclusive of the branch and seedlings, should be about $2.00 distributed as follows:

Frame	$0.50
Jap-a-lac	.05
Glass	.45
Card	.10
Map	.02
Wood sections	.25
Photos	.30
Label	.10
Corrugated board	.15
Screw eyes	.02
Total	$1.94

These preparations are especially helpful as demonstrations of the characteristics and habits of the trees. They may also be used as charts illustrating lectures. In this use they may readily be interchanged or transferred from one position to another, the screw-eyes at the top of the frame facilitating this operation. The weight of a single preparation is about ten pounds. As museum exhibits or as decorations of laboratory interiors they are attract-

ive and instructive. The attractiveness of the exhibit is much enhanced if the photographs are printed with a white margin. If such are not available the same effect may be obtained by attaching to the back of the picture a sheet of white paper large enough to project the desired distance beyond the margin of the print. The seedling should also be mounted upon white paper of a suitable quality and size. The use of white cards or margin gives a pleasing contrast and causes the objects to appear in relief against the dark background of gray board.

A Specimen Frame Illustrating Pinus Ponderosa.

Book Reviews

RECENT BOOKS ON EVOLUTION.

Darwinism and Human Life. By J. Arthur Thomson. New York, Holt, 1911. Pp. 245. $1.50.

Evolution By Patrick Geddes and J. Arthur Thomson. New York, Holt, 1911. Pp. 256. 75 cents.

The Evolution of Plants. By H. D. Scott. New York, Holt, 1911. Pp. 256. 75 cents.

Plant Life and Evolution. By Douglas H. Campbell. New York, Holt, 1911. Pp. 360. $1.50.

The Doctrine of Evolution. By Henry E. Crampton. New York, Columbia University Press, 1911. Pp. 311. $1.50.

Those whose interest in popularizing science leads them to an acquaintance with books which summarize scientific knowledge for general readers will need no recommendation of a new book by Professor J. Arthur Thomson, of Aberdeen, for a book by the gifted author of *Studies of Animal Life, Heredity, Outlines of Zoölogy* and *Science of Life* is sure to be readable literature and reliable science. *Darwinism and Human Life* is a series of lectures which explains the problems which Darwin set himself to solve, indicates the progress which has been made since Darwin's day, and finally suggests how Darwinism touches everyday life. Its chapters are as follows: I, What We Owe to Darwin; II, Web of Life; III, Stuggle for Existence; IV, Raw Materials of Progress; V, Facts of Inheritance; VI, Selection, Organic and Social. The human application in the latter part of the book will be most interesting to general readers who are already acquainted with the main facts of evolution. The Appendix contains an excellent list of representative books on Darwinism.

Evolution, by Geddes and Thomson, is one of the most readable existing books for general readers, and presents the facts, causes and bearings of evolution in eight chapters, as follows: I, Evidences from Explorer and Palaeontologist; II, Evidences from Anatomist, Embryologist and Physiologist; III, Great Steps in Evolution; IV, Variation and Heredity; V, Selection; VI, Organism, Function and Environment; VII, Evolution Theories in their Social Origins and Inter-Actions; VIII, Evolution Process Once More Reinterpreted. The absence of illustrations makes the book somewhat more difficult reading than Romanes's *Darwin and After Darwin*, Volume I, but it seems probable that most of this new book would be intelligible

to the general reader who has a fair amount of imagination. One possible objection is in the numerous references to the historical side of biology. Such references make the book intensely interesting to a trained biologist, but one questions whether the general reader is as much interested in the discoverers as in the facts which bear upon the theory of evolution. However, this is a minor criticism, and taking it all in all this book of "Evolution" by Geddes and Thomson is well worth reading by those who are interested in biological theory.

The great interest in animal evolution as it bears on human life has tended to cause neglect of the popular aspects of plant evolution. The volumes by Scott and by Campbell attempt to fill this gap and those who are interested in the botanical side of evolution will find these two books invaluable. Each covers the whole wide range of plant life, as will be seen in the following titles of chapters:

1. Scott—I. Introduction; II. Evolution of the Flowering Plants—The Problem; III. Evolution of the Flowering Plants—The Evidence; IV. Evolution of the Seed-Plants; V. Evolution of the Ferns; VI. Evolution of the Club-Mosses; VII. Evolution of the Horsetails and Sphenophylls; VIII. Conclusion.

2. Campbell—I. Introduction; II. Factors in Evolution; III, Lower Plants; IV, Origin of Land Plants; V, Seed-Plants; VI, Angiosperms; VII, Environment and Adaptation; VIII, Problems of Plant Distribution; IX, Human Factor in Plant Evolution; X, The Origin of Species.

Crampton's *Doctrine of Evolution* is a series of popular lectures which aim to present the main facts of evolution, some glimpse of the possible causes, and the philosophic bearings of the theory. The style is very satisfactory and as an introduction the book would be more satisfactory than Volume I of Romanes, in that Crampton avoids the controversial tone; but there is a loss in that Crampton's book lacks the illustrations which in lantern-slide form accompanied the original lectures. The main chapters of the book, which present the biological facts, might be made more useful to the general reader, and especially to students, if supplemented by a list of references to the illustrations in other books on evolution, especially those by Romanes and Metcalf. It deserves a place in the first rank of the books which introduce the general reader to the great principles and facts of evolution.

M. A. Bigelow.

The Animal World. By F. W. Gamble. New York, Holt and Co., 1911. Pp. 256. 75 cents.

The Animal World is not a popular natural history, as the title might suggest, but it is largely from the ponit of view of physiology and is chiefly concerned with presenting the similarity of functions through the whole series of animals. This is shown by the following chapter titles: I, Structure and Classification of Animals; II, Movements, Succession, and Distribution of Animals; III, Quest for Food; IV, How Animals Breathe; V, Colours of Animals; VI, Senses of Animals; VII, Societies and Associations; VIII, Care of the Young; IX, Life-Histories; X, Heredity and Variation. The book is an interesting contribution and will appeal not only to many who are already familiar with the facts, but also to many whose first study of animals is through the pages of this book. M. A. B.

Fundamentals of Agriculture. By James Edward Halligan, Louisiana State Experiment Station. Pp. 492. Published by D. C. Heath and Company, 1911.

This book is quite distinctive in that it represents the work of thirty-one authors, each of whom treats topics that are closely related to his own chief interest. As a result the book does not consist of a unified development of a line of thought, but rather is a collection of treatments of topics that relate in one way and another to agriculture. Naturally the style and relative simplicity of treatment varies, but this variation is much less than under the circumstances would ordinarily be expected, and it is at no time objectionable.

The range of topics is the widest yet presented in any elementary text-book of agriculture. A surprisingly large and compact amount of material is presented upon these topics and there are abundant citations to additional reference reading matter. The balance that is maintained between the different phases of agriculture is excellent. Many of the text-books in agriculture have not represented the science as a whole, but have dealt essentially with one or two of the other sciences from their applied aspects. The text here discussed recognizes and presents agricultural science as closely related to other sciences but as a distinct unit, different from all other sciences.

The large number of topics and the richness and the condensed nature of the information makes the book a compendium of elementary information upon agricultural matters. Many people not engaged in farming or teaching will find the book

most interesting; and all teachers of agriculture will find that the book merits their most careful examination. O. W. C.

New England Trees in Winter, (269 pages) by A. F. Blakeslee and C. D. Jarvis, published as Bulletin 69 of the Agricultural Experiment Station, Storrs, Conn.

There is a demand throughout the country for adequate means of identification of trees while in their winter condition. *New England Trees in Winter* is a most excellent means of such identification. A preliminary discussion of the tree includes the topics: habit, means of measurement of height of trees, bark, twigs, buds, scars, fruit, comparisons and distribution. Then in one of the two pages given to each tree each of the above topics is discussed relative to the particular tree under consideration. The other page presents splendid photographic illustrations of the form of the whole tree, its bark, twigs, bud, and often its fruit or its flowers if they are winter characteristics. The book is comprehensive and concise. It will be enthusiastically welcomed by the tree student, and by those who want a speaking acquaintance with trees. O. W. C.

Our Fruit and Nut-Bearing Trees, Our Oaks and Maples, Our Cone-Bearing Trees. Edith R. Mosher. C. W. Bardeen, Publisher, Syracuse, N. Y. Each volume $2.00.

These are thin volumes (about 50 pages) with large pages, quarto, to make room for the crayon sketches. To each tree two pages are devoted. One shows a sketch of twigs, leaves and fruit; the other gives a photographic reproduction of a single tree or groups of the species together with correlated quotations, many from the poets. The dedication is "To the Tree-lover who seeks also sentiment in this neighborly family of 'God's Out-of Doors.'" The aim is particularly to supply the nature teacher with suggestive sketches that will serve as models to pupils and to furnish quotations appropriate for children. The cost is almost prohibitive to the average teacher, though this is in part obviated by the paper covered books including only the sketches, also supplied by the publishers, 15 cents each. The volumes are worthy attempts to add to the appreciation of the trees.

Hand Book of Nature Study. Anna Botsford Comstock. Pp. XVII+938, with over 1,000 illustrations. The Comstock Publishing Co., Ithaca, N. Y. Price $3.25; postage 40 cents.

It is difficult to write a review of this book without intemperate praise. It seems quite within bounds to say, however, that it is one of the best single volume of nature study that has yet appeared, best in the comprehensiveness of subject matter, charm of presentation, and adaptability to the teacher's need. Needless to say, emanating as it does from so eminent a teacher of nature study, that it embodies the true spirit throughout. Part I or the teaching of nature study is brief but to the point. Part II is on animals and includes studies of birds, fish, batrachians, reptiles, mammals, insects and other invertebrates. Part III covers with equal thoroughness the interesting common plants, both cultivated and wild. Part IV is devoted to earth and sky. The subject matter is presented largely in the form of lessons, two hundred and thirty-four in all; and these aim to help the teacher lead her pupils to discover the facts for themselves. Only years of successful nature teaching with children for pupils could have made possible the selection of so much that is interesting to the child, the elimination of much that attracts the adult but wearies the youngster. The numerous illustrations are apt, well executed and lend an added charm to the text.

A Leaf Key to the Genera of the Common Wild and Cultivated Deciduous Trees of New Jersey. Mary F. Barrett, Upper Montclair, N. J. 6 pages. 10c. A key depending only on characters of the leaf.

The Home-Life of the Osprey. 54 pages, 32 plates. C. G. Abbott. Witheby & Co., London. 6s.

This is another one of the series of very excellent life histories of birds issued from the press of this firm. It is a photographic study of the life of our American fish hawk made during "the brief opportunities of a business man." It is an interesting demonstration of what may be accomplished by a lover of birds who is not a professional naturalist, as well as a distinct contribution to our knowledge of the habits of a valuable bird.

Boulder Reveries. W. S. Blatchley, pp. 230, 10 plates. The Nature Publishing Co., Indianapolis. $1.10.

This is a series of selections from the diary of a naturalist. Observation and philosophy go hand in hand. A few page headings selected at random will show how wide the scope of the book: A Wasp's Cache, Cloud Fantasies, Fence-corner Weeds, Mammon Rules Society, The Flight of Time, Trilliums and Wren, Oak Stump Fungi, Fame, Fortune and Love. Blatchley was for many years state geologist of Indiana, a scientist of repute. His observation is keen and his philosophy the wholesome, mature thought of the man who has tried to do his share in the honest work of the world.

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OFFICIAL ORGAN OF

AMERICAN NATURE-STUDY SOCIETY

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VOL. 8 FEBRUARY, 1912 NO. 2

Foreword

The study of nature certainly finds its greatest field of activity and application in the school garden.

This is the reason that all nature study workers for our children are warranted in turning to the school garden as the greatest theatre of nature-study work.

The school garden people of America are very glad, too, to welcome the movement on the part of the leaders of nature study to utilize the school garden more and more.

The greatest nature truths are learned in contact with the living being. The best education is the education of living. But the school garden people are interested in the school garden for quite another reason.

From many sections of the country we have heard mutterings of unrest as to the necessity of so many hard lessons and so long school hours for small children. Many people are fortunately beginning to realize that the close housing of our little ones in a totally artificial environment,—the classroom,—is a very questionable practice. Cannot the child be educated outdoors just as well as indoors? Would it not be much better for the child, before it is ten years of age, to remain in the classroom not over three hours a day and during the remaining time to be occupied in the open? The school garden, which brings the greatest industry and in every sense the most valuable practical training as well as healthful surroundings, offers in large part just this outdoor education. We must come to see that this is the fundamental form and chief content of education.

The School Garden Association of America is very grateful to the Editor of the NATURE STUDY REVIEW for the opportunity to present the cause of school gardens in the REVIEW.

The articles that are herein published were read at the first National Convention of the Association held in July 1911 at San Francisco. It is to be regretted that Mr. Horchem's excellent paper had to be cut down on account of space.

It is hoped that an affiliation may be perfected between the American Nature-Study Society and the School Garden Association of America. The report of the committee of the School Garden Association of America is herein presented.

The committee are congratulated upon presenting so workable a plan. Most of the cuts used in this number were loaned to our Association and I am happy to thank the donors at this time.

VAN EVRIE KILPATRICK,
President of The School Garden Association of America,
4852 Broadway, New York, N. Y.

A PRIZE WINNER CORNER OF SCHOOL GARDEN AT P. S. 52, NEW YORK CITY.

Practical Aid to the School Garden Movement by the United States Department of Agriculture

Susan B. Sipe

Collaborator, United States Department of Agriculture.

I bring greetings to this new organization from the Bureau of Plant Industry and the Office of Experiment Stations of the U. S. Dep't of Agriculture, Washington, D. C.

Realizing that the successful farm operations of the future depend upon the children of the present, the Secretary of Agriculture keeps himself informed of the progress of elementary agriculture throughout the country, through the chief of the Bureau of Plant Industry, Dr. B. T. Galloway, and the chief of the Office of Experiment Stations, Dr. A. C. True.

The Office of Experiment Stations confines its operations to the theoretical side of the school garden movement. It is a clearing house for agricultural information. It has a catalogued collection of the courses of study of all agricultural institutions. It has photographs and slides of school gardens all over the country at the disposal of any teacher. By applying to the chief of the office and stating the line of development needed the necessary slides will be forwarded to you. It shows its appreciation of efforts on the part of teachers to promote children's gardens by sending representatives to visit and report on the work; by asking teachers to write for government bulletins such lines that they have been especially skillful in, thus giving the rest of the profession the benefit of their work at practically no cost.

The Bureau of Plant Industry looks after the practical side of the movement. It has prepared and sent out to schools four special school garden sets of seeds: one designed to meet the requirements of the individual vegetable garden; one to meet the requirements of the individual flower garden; a third providing plants suitable for decorating school grounds, and a fourth collection consisting of economic plants of the several sections of the United States, embracing cereals, forage crops, grasses, food and fiber crops. In this collection eighteen (18) standard varieties of plants have been used. This collection was designed to meet the requirements of the students of geographical botany, as well as to supply material to familiarize students with plants not

only of their own locality, but of other important agricultural regions. Four thousand (4,000) requests were received for these collections last year. Less than 3,000 were complied with. In filling these requests 350,000 packages of vegetable seeds, 200,000 packages of flower seeds and 36,000 packages of economic seeds have been used. They have gone to every state and territory in the United States but Arizona and Nevada; to Alaska, Hawaii, Panama, Porto Rico and the Philippines. This bureau has also published a general school garden bulletin treating of methods and plans of school gardens, together with laboratory exercises for both indoor and outdoor gardening. A second bulletin has been published on window-box gardening.

During recent years an effort has been made to provide planting plans for higher grade agricultural institutions. Consolidated schools offering instruction in agriculture as well as agricultural high schools and colleges have been included in this scheme. It is not deemed possible to extend the courtesy at this time to city schools and small rural schools owing to the limited force which can be assigned to this work.

The Bureau of Plant Industry has also used the Normal School at Washington and the public schools of the District of Columbia to test the practicability of gardening in city schools. It furnishes the Normal School with a greenhouse where the student teachers are given a course in their senior year in plant propagation. The material thus grown is used in beautifying the school grounds of the city. Until two years ago it furnished land in the park surrounding the office buildings sufficient for 350 children to cultivate gardens. The erection of the new administration building necessitated the abandonment of this garden, but a coöperative agreement has been entered into whereby these two bureaus here represented still continue their aid to the schools, and in return the writer of this paper makes an annual report to the Chief of Experiment Stations, placing special emphasis on any new features, and has inspected and reported upon, without compensation, the status of school gardens in New England and the Middle West, the states west of the Rockies, and in England.

The work in Washington stands preëminently for training of its teachers through the Normal School; for home gardens both of its student teachers and children; for systematically teaching the subject in its graded schools by means of a course inserted in the nature study course, and for the moral influences of garden work. In this latter connection it is well to refer

to the efforts on the part of the teachers to prevent vandalism in private flower gardens and public parks. Several reports of stealing and destroying shrubbery came to the undersigned this past spring. Gardening seems especially adapted for the teaching of property rights. The child recognizing the labor connected with the preparation and cultivation of a garden is more than ready to protect his own property and should respect the rights of his fellow laborers. This is a social service that can be learned by the children only through the untiring efforts of the teachers. The superintendent of schools, A. T. Stuart, issued the following circular to the teachers:

April 6, 1911.

To Supervising Officers:

Within the next few weeks the city will be beautiful with flowering bulbs and shrubs. Many of these will be found in beds that have been laid out and planted by the hands of children in the schoolyards; others in private yards where the pride of the housekeeper is aroused to a degree by the interest of the children in growing plants; and still others in the numerous parks that adorn the city.

Much has been done in the past eight years by the teachers to create in their pupils an appreciation of nature's attractions and to give them at the same time definite instructions in planting and caring for flowers.

Not the least valuable part of the work in school gardening has been the moral influence upon the child. There is no doubt that the love of the children for their own flowers has made them more careful of the rights of ownership of their neighbors and less destructive than they otherwise would have been. There is still need for the systematic instruction by the teachers upon the importance of respecting public and private property, particularly with reference to plants and flowers.

I therefore direct that the teachers in all grades of school endeavor in every way to create among their pupils an interest in the preservation and care of flowers and shrubs, not only in school gardens, but on private premises and public parks.

Repeated lessons should be given from now on, having in mind the cultivation of a right public sentiment in the community against the spirit of vandalism which unfortunately is as common among adults as children. Home and School Associations and parents generally are invited and urged to coöperate with the teachers to this end.

Respectfully,

[signed.] A. T. Stuart.

It is a pleasure to state that there has been a marked respect paid to the rights of others by the children since this concerted effort on the parts of superintendent and teachers.

It is the office of the Department of Agriculture to help the school garden movement. It desires to do so. It expresses its willingness to do so by sending a representative to this meeting. Its publications, its seeds, its slides, its advice are yours. Use them.

The School Garden as a Center for the Teaching of Nature-Study

R. O. Johnson

Head Department of Biology and Agriculture, State Normal School, Chico, Cal.

Among a number of reasons why, as it appears to me, the school garden should be made the center for the teaching of nature study is that man in a garden is, *par excellence*, at the meeting point or focus of all the forces with which he has to do, and the child in the garden (a little world in itself) is placed on a battle ground of opposing natural forces which are identical in kind and behavior with those which he must necessarily meet in his subsequent life. What better place than a garden (a little world of its own) can be thought of as a schooling-place for the boy and the girl, the future man and woman? Our first parents in the childhood of the race were put to school in a garden as a preparation for the later life and directed to dress it and subdue it and make it to bring forth fruit for sustenance. The garden seems thus early to have been considered an ideal place for the most profitable sort of education possible for man, namely, an education which fits him successfully for the work of turning Nature's forces to his own account. Now one of the most comprehensive, widely accepted of present day aims for the teaching of nature study is such a preparation of the child through the study of nature as will enable him to deal in a masterful way with the forces of nature, thwarting the bad, assisting the good, and turning all to his own advantage. We see therefore that what nature study *aims* at, the work of gardening *does*, hence the value of making the school garden the center for the nature study work.

Furthermore there is, to my mind, nothing, which, for the child, better combines the serious and the pleasurable and to such a degree, as does the work done in the school garden, and this notwithstanding the fact that pupils can and should be made to understand and appreciate what constitutes an honest hour's work with the hands. Nature study learned by the doing of actual work in the garden gives pleasure largely because it affords a means of combining learning with pleasant activity, gardening being in itself a health-giving out-of-door exercise. Not a little of the pleasure derived from nature-study so taught is that which comes from merely seeing things grow. This

is particularly true of the primary grades but is not confined to these grades. The first appearance of the plant above the ground, the appearance of the first bud or blossom, and the first radish grown to a size making consumption worth while, are occasions for the display of hilarious enthusiasm. A man of middle age who lives near me and alone is engaged in the somewhat prosaic work of hauling gravel for a construction company. He must leave home early in the morning and return rather late in the evening, taking all his meals during the day away from home. But despite this very serious handicap, and his ability to make use of the things grown, he has a somewhat

SCHOOL GARDEN IN A CONGESTED QUARTER OF NEW YORK CITY P. S. 41, NEW YORK, KATHERINE BEVIER, PRINCIPAL.

pretentious garden. He says he just likes to see things grow. And who does not like to see things grow? There cannot be the least doubt that boys and girls all do. But there is something still better than the pleasure he derives from seeing things grow, for it seems to me a truth almost axiomatic, that it is impossible for one to like to see things grow, without himself growing by virtue of that fact. And to the child especially as he becomes older, the pleasure attendant upon this self growth surpasses even that derived from seeing growth in other things. Few things, if any, can produce in a child, a higher degree of pleasure than the discovery that he has the ability to bend nature's forces

to his own will in the rearing of a plant. Furthermore it seems to me impossible that one could be conscious of such power without being made stronger, more independent, more resourceful as a result of such consciousness. Indeed I believe that the subjects to be found in the curriculum are efficient or inefficient according as they give or fail to give such consciousness. Thus we see that the garden begins to cultivate in the child very early in life those qualities which the later man and woman must of necessity possess in order to succeed. It would be, it seems to me, a serious mistake to give a course in nature study which would not make use of the garden in the way above indicated in the realization of its most widely accepted aim.

Secondly, and following as a result of what has been said above, the proper use of the school garden furnishes the pupil a most potent motive for the learning of the formal lesson in nature study. The boy or the girl who desires to grow plants successfully, and few of them when rightfully taught do not, are given a powerfully compelling motive for the study of such things as plant structures and functions and the relation which these bear to the need of plants for light, air, heat, moisture, food, and soil, as well as the relation of plants to each other. The fact that his garden plant constantly needs moisture and that the supply of moisture needs regulation supplies the pupil with a real motive for the study of the various uses which the plant makes of water, the movement of water in the soil, the forms in which the water exists in the soil, and the various methods by which water is applied to and conserved in the soil. The two points last named open up to the pupil in a natural and interesting way the whole subject of irrigation and cultivation, and dry farming methods which are now coming into such general use. The packing of the soil consequent upon certain methods of irrigation paves the way for a desire to know the means by which the soil may properly be aerated, and the great importance of aeration of the soil in supplying the underground portions of plants with oxygen, and also the function of air in the preparation of available plant food generally. Continuous cropping with the same crop for a series of years and the consequent reduction in the amount of available plant food in the soil opens the way very naturally to, and gives the child a desire to know something about, the plant foods, the various forms in which these exist in the soil, how soils become depleted of available plant food, and how the supply of available plant foods may be renewed in the soil, the need for the application of fertilizers both natural and artificial, the effect of crop rotation on soil fertility, and the relation which tillage bears to soil fertility.

The damage by animals, which is almost certain to occur to plants in his garden from time to time, furnishes the pupil a pressing motive for the study of harmful animals, such as gophers, rabbits, ground squirrels and other rodents, moles, insects, some birds at particular times and even barnyard fowls, when, as is

A RHODE ISLAND SCHOOL GARDEN.
PICTURE LOANED BY THE EXTENSION DEPARTMENT R. I. STATE COLLEGE. E. K. THOMAS—SCHOOL GARDENS.

often the case, the school garden is in close proximity to their customary feeding grounds. Pupils will gladly embrace the opportunity to learn all they can about structures and habits of animals so that they may be better able to devise means of extermination or effectual control, and sometimes even of preventing attack, thus developing within themselves an inventiveness and a resourcefulness which cannot but be of great value to them in later life. The study of rodents and insects and birds in their relation to the school garden furnishes a most excellent point of departure for the study of these things in general should it appear advantageous in any locality to make such a study. The intensest interest will attach to the study of parasitic and predaceous insects, and insect-eating animals because the pupil naturally desires to be able to avail himself of Nature's assistance, where such a thing is possible, in ridding his garden in a compara-

tively easy and effectual way of various pests. The invasion of their gardens by weeds will afford the strongest kind of incentive for the study of the means by which plants, especially weeds, are disseminated, the need for co-operation among all the members of an entire community in the war against weeds, the need for protection of birds which eat weed seeds, and the various means by which weeds may be eradicated or effectually controlled. The dependence of successful plant growth upon the weather furnishes the pupil with a motive for the study of weather conditions generally. All these topics will be found to offer the most intensely interesting kind of materials for nature study lessons and since they all, as has been seen, grow naturally out of the school garden, it would be regrettable loss to take them up in any other connection. Hence a second reason for making the school garden the center for the teaching of nature study.

Not only does the garden supply the children with motives for making a careful study of nature, but the parents are more likely to show a sympathy for, at least, a fair degree of toleration for nature study work. There are comparatively few parents who cannot see a certain amount of benefit in teaching the children how to prepare, plant, cultivate, harvest, and market the products from the school garden. On the other hand many of them can see little real benefit to their children in studying objects of nature in isolation, bearing as they seem to do in so many cases when thus studied, little or no relation to man's welfare. The school garden is thus seen to give us a means of enlisting the sympathy and co-operation of the home in nature study work.

Again the school garden furnishes easily accessible material for the nature study lessons and usually an abundance of it. The problem of supplying each pupil with a specimen of the thing studied (something much to be desired in nature study), is thus greatly simplified and in most cases entirely eliminated. In a similar way the practical problem of studying things in their natural environment and of keeping them under continuous observation within their natural environment are minimized. The study of things occurring naturally within the immediate environment of the pupil is also guaranteed as well as the things which stand in vital relation to him. The teacher who uses the school garden as a center for the work in nature study will experience comparatively little difficulty in preparing the field lesson, a problem not so easy of solution when the work is taken up in miscellaneous fashion, especially when the teacher is following a ready-made course which is not based upon the school garden. By such previous preparation of the lesson the field work is given

definiteness and the attention of the pupil to the main line of thought is not so difficult to hold. Nature study based on the school garden is more likely to be a study of real things in Nature than a study about things as found in books. The school garden furnishes the teacher with a limited amount of material from which it is comparatively easy to make a selection of topics really worth teaching and upon which it is a comparatively simple matter to prepare herself, and to collect literature, thus practically eliminating what, to the teacher, is one of the greatest practical difficulties encountered in nature study teaching, and

A PHILADELPHIA SCHOOL GARDEN.

removing one of the strongest indictments heretofore returned against nature study in the schools, and properly too, namely, its indefiniteness.

Once more the school garden taken as a center for the teaching of nature study guarantees a closer correlation of nature study with other subjects in the curriculum, acting upon them to their material advantage, adding a touch of life and an element of living interest to them, and being reacted upon in a desirable way as a result. The fact that the tools used in the school garden have to be mended from time to time guarantees that the work in nature study shall be brought into correlation with manual training; the keeping of the daily diary of work done and its results connects it vitally with the work in English; the laying off of the grounds connects closely through simple surveying processes and geometry with the work in mathematics, as does also the keeping of accounts to determine the cost of the production of the crop;

the marketing of the garden produce opens up a number of questions in practical political economy, such as, the relation of supply and demand, manipulation of prices, co-operative marketing, and earning capacity of lands. The consideration of some of these topics will also involve a knowledge of geography including the subject of transportation; the preparation of garden vegetables for food will lead naturally to a reference to domestic science.

Finally the use of the school garden as a center for the teaching of nature study guarantees that a number of exceedingly interesting and profitable lessons are to be learned incidentally in their nature study work. One of the most useful of these lessons is the respect which pupils who take gardening come to have for the man who works with his hands, the lesson of the dignity of manual labor. Young people are driven from the farm not only by their lack of interest in farm work, but also by false pride with regard to manual labor. Hence many of them go to the city to seek a means of earning a living in some, to them, more ennobling way. In the garden pupils also come to have a sense of ownership and to see clearly the difference between mine and thine, a fact not always very clear to a somewhat large percentage of young Americans. They also come by a sense of proprietorship which gives them a proper feeling of independence and strength and self-respect which cannot easily be gained in any other way. J. J. Hill, the railway magnate, points out the fact, that, next to self-preservation, the strongest instinct of the human race is the desire to own something, that is, to be a proprietor, and that one of the best preliminaries for young people preparatory to launching out into life is early to acquire the strength and independence that comes from and is attendant upon ownership of something, however little that something may be. Closely connected with the foregoing is the fact that pupils through finding the cost of crops in labor will come to have an appreciation of the real value of money, an exceedingly profitable thing for the boy and the girl to learn early in life, as a needful preface to the formation of habits of thrift. The opportunity which the school garden gives for teaching the pupils what constitutes an honest hour's work and for teaching coöperation and neighborliness has been pointed out above.

Nature study put into actual practice in the school garden gives excellent opportunity for the inculcation of habits of neatness and orderliness, and demonstrates strikingly to the pupils themselves the value of these habits. In a similar way, through neglect of cultivation and irrigation, the pupil learns the bad effect of allowing work to accumulate. The garden left to itself

through the summer months preaches eloquent sermons on this subject to pupils returning in the fall. It is not difficult to lead pupils to see that the mind is a garden in which "whatsoever a man soweth that shall he also reap," in which noble thoughts and deeds are the flowers and the vegetables, while ignoble thoughts and acts are the weeds and other destructive agencies which intrude themselves into our gardens to mar and to crowd out the things which are useful. Every one who plants a seed and looks forward to a harvest learns a lesson of hope and faith in the

P. S. 38 BRONX NEW YORK CITY. ELLEN MURRAY PRINCIPAL.

future, without which all work becomes drudgery and all real life unbearable. The springing of the plant from the seed hidden away in the soil makes concrete the fact that to lose one's life in service for others is the only way to find it again unto life eternal. The chrysalis of the butterfly teaches clearly and strikingly, where words are dumb, the facts of the immortality of the soul, and the hatching of the insect egg the fact of the resurrection. Last of all and crowning all of the incidental lessons taught by the garden is this, that the garden may and does become to many, the one spot in nature where the soul is lifted to its Maker.

"A garden is a lovesome thing, God wot!
Rose plot,
Fringed pool,
Ferned grot,—
The veriest school of peace.
And yet the fool contends
That God is not!
What? Not God! In gardens!
When the eve is cool!
Yea, but I have a sign,
'Tis very sure God walks in mine."

School Gardening, a Fundamental Element in Education

B. J. Horchem.

Superintendent "Park Life," Dubuque, Iowa.

Fifty per cent of the children die before they reach the age of five. Fifty per cent of the rest leave school when they reach about the fifth grade, and fifty per cent of those who graduate from the high school or other higher institution fail, despite the fact that only two per cent graduate from the high school, and only one-half per cent from the college or university. Three-fourths of those that finish these institutions have plenty of means and their failure is not noticed. Twenty-five per cent fall into the bread line in the large cities. Thoreau says, "To be poor in a wealthy country, to be sick in a good climate, to be inefficient among a progressive people, is a sign of unwise educational methods. . . . They were not taught to battle with the world or to meet life's emergencies." "Be not simply good, be good for something."

It may be said that no one objects to school gardens; that they are desirable for ornamentation and for usefulness. But the use of the word "fundamental" in this connection should be explained. "Fundamental" is a very strong word. Why should we regard as fundamental a feature of public education which until recently received no attention whatever and which today is still in the early experimental stage?

Let me say that the word "fundamental" is none too strong to be used in this connection. This newer feature of school life is really fundamental in its need and importance today, and lies at the very base of intelligent plans for the school work of the future.

In the first place the school garden with all that it involves is fundamental in its relation to the *physical* development of the child.

It may be asked what is the connection between the open air diversion of school gardens and the continuance of pupils in school. But few pupils are positively forced against their will to leave school. It is the child who goes to school reluctantly, unhappily, and a subject of constant exhortation, who is most apt to drop out of school. Most parents are indulgent and seek the happiness of their children, and are willing to make any sacrifice to enable them to gratify their desire to keep on

with their studies when these are found to be both profitable and enjoyable.

The moral importance of the school garden, if properly expanded and developed, is also a fundamental. A vacation season without employment for either mind or body, without the supervision of teachers or parents, may easily undo the work of the year in moral training. Prevention is better than vain attempts at the cure of society's evil. The wholesome continuance of inspiring, enjoyable, and profitable living for twelve months in the year is the true antidote to progressive vice and criminality. The weakness or limitation of the school garden plan in its failure to provide for the vacation period, is every-

A View of Park Life Boys at Work, B. J. Horchem, Supt.

where admitted. With the idea rounded out to include the whole year, the largest measure of usefulness will be achieved through it.

The operation of school gardens in the vast and crowded cities of Chicago and New York—where one might least expect to find them, yet where the need seems to be greatest—is a most notable event in recent educational history.

After studying the social conditions in New York and Chi-

cago I came to the conclusion that those who lived there were doomed. We have studied history all these generations, and have been taught that all congested cities were doomed to fall. Rome, among other ancient cities, fell, because its men of blood and muscle had to go to the wars, and the people of the congested parts lost their vitality. Every third generation ought to revert to the soil. I came back to Dubuque and congratulated the people of my ward upon the happy conditions in which they live. The majority of them own their own homes.

After seeing the conditions in the large cities and studying the happy conditions of our own laboring men; after hearing some one say that no one should be allowed to live on the streets, but in parks, and another say that children should be educated in the open air; that they should be taught homecraft, agriculture, etc.—those things that help to make happy, contented homes; and another that the weakest point in our educational system is the long vacation; after considering all these conditions, I thought of a plan that would do away with these evils. We selected the name "Park Life,"—as suggestive of people with homes of their own, with little parks around these, and with surely an ideal place to live. They will live "Park Life", not slum or tenement life. People so raised and educated, whether in school or home, become steady, reliable, and skilled workmen. Manufacturers can depend upon them and are coming to realize this, and will establish factories in cities that have laborers of this class.

Now the object of "Park Life" is to teach the children how to raise the different vegetables, fruits, and flowers, and to take care of things so raised, and to teach them to cook these. Then they can go home and run their own gardens, keep their own chickens, and help to make life happy and contented.

There is a good deal in the old saying about the need of returning to the soil every third generation: "Park Life" has to do with the vitality of the child. The internal conditions of a life are more important than the external. A person who has the vitality, the resisting power to beat off every onslaught of disease, is far better off than he who is kept well simply by guarding himself.

Therefore you can readily see that the boys who are brought up in a school like "Park Life" are trained in the right channel, and built up with strong, healthy bodies. They become men and women who desire a home with a piece of ground on which to raise their children.

The healthful, natural development of the minds and bodies of the children of America is not too great an undertaking. In its importance, it dwarfs all others. With the right training of youth, the social problems of the nation will solve themselves. Let the charm, the dignity, the wholesomeness of out-door life be realized by the growing generations of today, and the mad rush to the cities will cease of itself.

There should be schools in the suburbs of our cities, and these should be in session through the entire year, but only half the time should be spent indoors. The summer term in the suburbs should be the longer term, and should be devoted to teaching how to live, how to get a living, how to grow food, and how to cook it; how to make a home, and how to keep it and improve it; how to gain health and strength, and the power to work with hands, as well as heads, and to do a full share of the work of the world. These things are not learned from books; and more than anything else, the children need to learn them. Once they have learned them, they will solve the tenement problem for themselves. They will be as eager to avoid the slum districts as they would be to fly from the Black Hole of Calcutta; and they will find a way. The modern cave-dwellers will become cottage dwellers and home owners with park-like gardens.

There should be a model school in every suburb of every large city, with its vegetable garden, flower garden, tree culture, animal raising and training. It should not be the object to raise poultry, vegetables, grain, fruit, and animals for their own sake, but to have through them and by them all, some boys and girls taught aright, that these boys and girls may know how to take intelligent care of themselves.

If we wish to strengthen the foundation of our nation, and to preserve it, we must not let it fall into decay. Education through nature-study in the garden out of doors will develop the children who will take care of these problems in the future.

The inception of school gardens can hardly be called new in the West. The celebration of Arbor day in the rural schools has been in vogue in many states for a long time. This institution has had in view chiefly, if not exclusively, the schools of rural districts and the small villages, and it contemplates the devoting of a single day in the year to the planting of trees and shrubs. Then came the school gardens, merely for the purpose of showing the pupils how to plant, but the garden was allowed to grow into weeds during the summer vacation.

The idea of "Park Life" in the city of Dubuque dates back a number of years. It has steadily grown and developed through a natural evolution until it embraces an ever widening circle of interest to pupils, physically, intellectually, and morally. I am prompted to present here briefly and in order the steps in the development of "Park Life," at Dubuque, which is an enlarged conception and a distinctive name embracing school gardens as a fundamental.

I do this because of the wide publicity that has been given to it through the educational and secular press of the country, which has been most generous in giving space to the subject, and because of the sympathetic encouragement it has thus far received at the hands of educational critics, sociologists, and others; and a further reason is the large number of interested inquiries which come into Dubuque concerning "Park Life," indicating a popular interest and a desire for particular information as to its purpose, plan, and progress. I make no boastful claim of having conceived the full idea at the beginning. The plan started simply with the recognized need. We grew and expanded naturally, for we learned to do by doing, and one step forward suggested another.

The plan includes the continuation of pupils in outdoor work during vacation, with all that this implies of regular habits, life in the open air, personal comfort, avoidance of contamination through the evil influence of cities, etc.; the continuance through the year of the acquisition of knowledge, and the development of thought power through open air lectures, readings, conversational discussions, debates, etc.

The idea of the traveling school is here carried out. By this is not meant expensive trips to Europe or to Yellowstone Park, but excursions to places of real interest—historical, geological, or otherwise scientific, literary or economic—places reached by little journeys which offer opportunities for advancement in a multitude of ways.

I am not a believer that everybody should learn gardening for the purpose of making money, or for the purpose of getting rich at it, but for the purpose of keeping the mind employed, of creating an interest in public affairs that will lead to the establishment of public improvements, the conservation of the water supply, and river regulation, so that all those who have homes can have all the water necessary for irrigation, which, together with fertilization, can bring returns that are profitable and enjoyable.

Growing Children in California Gardens

CYRIL A. STEBBINS.
University of California.

We grow flowers, vegetables and children in California gardens.

A prize polyphemus-moth, gorgeous in its colors, magnificent in its expanse of four inches, came to us from the fairyland of butterflies and moths less than a year ago. The following day we found her dead with forty odd eggs to complete the embryonic chain. We marveled at Nature's mysteries as she helped the young caterpillars from the egg and started them on the long way. Each day we fed the young, but we, in our ignorance, failed to satisfy their needs. We interfered with the water supply, we gave food which we felt they ought to have. All but four died, and these four were undersized.

VINELAND SCHOOL GARDEN, LINCOLN CO., ONTARIO.

CUT LOANED BY S. B. MC CREADY.

A boy is no more a miniature man than a larva is a moth. He is the caterpillar stage of a man, the growing stage. Interference with nature in producing a moth results in a weak moth. Interference with nature in building a man results in a weak man. The factor of growth, the factor of evolution, must be taken into consideration in any sane system of education.

The amoeba was the lowest form of animal life. It was potential in all those factors which made for a complicated animal. It carried on its processes of metabolism primitively with no specialized organs. After thousands of years the small beginnings of a digestive system began to appear in sac like animals such as the sea anemone. The mysterious driving power for perfection slowly but irresistibly fashioned still higher animals which had to meet changing situations, sometimes dangerous, sometimes otherwise. Thus the animals shaped themselves to meet their developing needs, and the system of muscles arose. Tyler says a muscle is like a steam engine. It

needs fuel elaborated in the form of carbohydrates; it needs a method whereby the fuel may reach its place of need; it needs oxygen for burning; it needs a method of handling waste tissue. Thus arose the circulatory, the respiratory, and the excretory systems. Ascending from the low plane of animal life to the high, the worm-like animal, the fish, the arboreal animal, gave successively to man the old fundamental muscles of the trunk, the shoulder, and the thigh, the new accessory muscles of the arm, the leg, and the fingers. The pull of the trunk muscles developed the spinal cord of the nervous system. Exercise of the appendages developed the cerebellum; the cortex and association areas arose from the activity of the appendages and the special senses.

The fundamental muscles are those of the trunk, the shoulder, and the thigh; the fundamental parts of the nervous system are the spinal cord, the medulla, the mid brain, and the cerebellum. All of these are old and their growth is a matter of the caterpillar stage. One would question the desirability of building a house on sand, yet in our steamroller way we try to build a perfect man on an undeveloped boy. The caterpillar stage of a boy is spread over some twelve years of his life, and should be a stage devoted to growth and to development of the fundamental muscles and the fundamental parts of the nervous system, for he repeats in his development the history of his race.

Just as the individual has a racial body so has he a racial mind. He recapitulates the civic and moral history of his people. Successively he is savage barbarian, semi-civilized, and civilized. At each period of his recapitulation, the racial urging of that period expresses itself. We must not try to eliminate these periods of growth. We must not try to make the boy omit his period of savagery any more than to try to eliminate or shorten the caterpillar stage of the moth. We must not interfere with nature as she fashions a man out of a boy. Rather let us make his environment such as will direct naturally his growth and his racial impulses.

We are told that, due to the interference of parents and the school, children at twelve years of age are 10 per cent below normal vital capacity. The parents tell John to sit still, the school makes him sit still. He sits still, and from the adult point of view a good boy is made, but really a good man has been spoiled. If the school cannot make him sit still, if the demands for growth are too strong, the boy is a misfit and

P. S. 93, Brooklyn, New York.

CUT LOANED BY SCHOOL GARDEN ASSOCIATION OF NEW YORK.

leaves school temporarily or permanently. Again John may be made to sit still, yet saves himself from crystallization through his dullness. Fulton, Newton, Seward, Sir Walter Scott, John Hunter, Pasteur, Shelly, Herbert Spencer, Patrick Henry, Pierre Curie, Thackeray, Oliver Goldsmith, James Russell Lowell, and many others were average pupils, and many were considered dull. They were fundamentally too strong to be standardized by the school.

The school may help nature in growing men and women through the garden. Through it the children may be led to those factors which make for natural physical and mental growth. Racial impulses both physical and mental are satisfied by environmental factors. Examination of one's environment, or community, reveals four factors which make for its life—the market, the bank, the press, the factory.

Each of the four factors alluded to may be traced back to the soil, to agriculture. Agriculture, the soil, is the fundamental stuff out of which communities are built. Migration—roving from place to place, primitive agriculture, marketing and trading, banking, manufacturing are successive steps in civic evolution. Through the garden, the school may repeat this civic history and the children may be brought in contact with community factors.

School gardens had been under way in the Ohio State Normal School several years before the above thought was demonstrated by the writer. A market was established. Many of the gardeners made from 5 to 75 cents off of plots 4x6 feet. Naturally, to handle the new financial activities a bank was established. This institution took charge of the gardens and leased the individual plots to the children for 10% of the output. The seventh grade bookkeeping class was put in charge of the bank, thus vitalizing the bookkeeping work. The bank handled over $50 a month, and the children were brought in contact with all its activities.

Continually we felt the need of a printing outfit. A complete office was installed with business manager, operators, etc. Boys out of joint with the school system were remade in the printing office. A weekly newspaper and a magazine issued twice a term offered new and vital outlet to the art and English departments. The printing office furnished stationery for the bank.

Through actual harvesting of the economic plants, sugar beets, flax, hemp, etc., the garden pointed the way to the work

of the world and brought the children to the factor of manufacturing.

The motivating thought behind the market, the bank, the press, the factory, was to bring the children in contact with the social and business activities centered upon each in the community that the pupils might early become acquainted with their future working field. With the gardens and agriculture as a center, a miniature world, containing the factors which are vital to community life, was readily produced.

A school has two fundamental functions: (1) to produce a well rounded man with a moral aim as the motivating factor; (2) to make him fit his future working field. The latter function is the greater of the two, for if a man "fits" he is a whole man.

If these aims constitute the kingdom of the school, shall we be amiss in examining the "future working field" for the factors which make for its being? With these in hand shall they not become a part of the curriculum of the school that they may offer their essence to the children during their school life?

If we desire to teach a man to swim at twenty we must make him acquainted with the water before nineteen. If the school desires to make a boy fit the place of his future labors socially and otherwise at sixteen it must acquaint the boy with the factors which constitute this field, previously.

Analysis of community life reveals two main factors: (1) a factor for pleasure and repose; (2) a factor for the more serious affairs of life, namely, those of business. Its life of pleasure contains the elements which are in tune with warped or unwarped senses. The difference between true and false pleasure depends upon the conditions of the senses, whether attuned to artistic dishes, at artistic hours, whether loyal to old Nick or attuned to the sky-city at night with its countless shining lights. One is satisfying, the other leads to discontent. One is true pleasure, the other is mere sensation. One is in harmony with the driving force within forcing the destiny of the world to better things, the other is antagonistic.

The business life of the community contains four leading factors: (1) the printing office; (2) the bank; (3) the trades; (4) the factories.

One fails to find these factors in the life of the school, yet these are the very essence of the working field of the pupils. Essentially a school should have within it those things which are vital to community life. The school should be a miniature world giving the child contact with world forces, that he may

develop in them, with some freedom of choice, and not as some biased individual directs.

To me the school is leading the children into the "blind alleys" rather than out into the wide avenues. It is trying to lead national and community life rather than to follow it. Sweep the school aside and the world would progress, but with some friction. The school arose to allay friction. It first was the family. The natural environment was the school room; those things immediately in touch with the child and the family were the materials; the parents were the teachers, and what would best work out the happiness of the family and the race with the least amount of friction determined the methods. The child was taught to help build a home; to make and to use tools; to hunt and to prepare his food; thus to relieve in as many ways as possible the friction in his daily life.

Conditions soon became more complex, and new vehicles, reading, writing and arithmetic, were called to carry the new complexities.

We question any legitimate call for much of the geography, history and arithmetic, etc., which has come to be a part of the twentieth century school. We doubt that the community ever needed cube root, the least common multiple, the greatest common factor, etc., etc. If the community life ever called for such stuff, times have changed and these subjects no longer fulfill any important function. The school is demonstrating its ability to lead.

The universities and agricultural colleges have done and are doing much for the betterment of agricultural conditions. They are coming to recognize the potentiality in the children and are now forming and following plans to better not only our national growth but that of the school through agriculture—agriculture in its broadest sense. In 1910, the University of California set aside a sum of money to take agriculture to the schools. Our plan has been and is to make school life a copy of the community life, to link the school and the community through the agency of the school garden, thus to satisfy the growth of the racial body and mind of the children. Less than five months ago the Division of Agricultural Education of the University of California offered to the Whittier school of Berkeley land, water, tools, and seeds in return for the boys and girls of the fifth and sixth grades. The children came to the campus gardens but one hour a week. They were divided into groups of eight and placed in charge of students in the University. The past term we

have been satisfied to gather momentum slowly, ever looking forward to the embryo community. Many mothers have become interested. Two brought in some forty children twice a week, taking all responsibility upon themselves.

An interested mother came to the gardens a short time ago in search of fresh radishes. She discovered a young gardener of tender years well laden and ready to market her products. Terms were soon made and the little girl clutched eagerly her five cent piece, the first ever earned. The following day she demurely edged up to me and said, "Mr. Stebbins, may I have another garden?" The little girl felt the economic pull which we wish to utilize in this term's work. A market will be established and we confidently expect each plot to average at least $1.00 for its owner. With a bank under way, the plots will be leased at a rental of 10% of the garden's output. Gradually around the campus gardens we hope to build an embryo city in which the children may grow mentally and physically with the vegetables and the flowers. The campus gardens will become our laboratory. Here we shall benefit by trial and error until a system may be perfected which will be extended over this whole state.

With the gardens on the campus under way, the University Division in order to extend its usefulness offered to four rural and two other city schools, seeds and teachers in return for the sixth grade children. Members of an extension class, composed of post graduates and upper division students of the University, followed an instructor into these schools, teaching agriculture one hour a week. In each instance the garden was made the basis of the work. The division met the expenses of these students.

In this manner over 500 children were reached directly. Desiring to increase the service of the division, the "Junior Agriculturist," a small paper, was published twice a month and given free to the children. The "Junior" had a fourfold purpose (1) to enable the department to reach more children, (2) to review the lessons taught by members of the extension class, thus acting as a live text, (3) to bind the whole movement together, (4) to act as a medium of expression for the children and the teachers. The little paper has been an essential factor in the past term's work. The mailing list has grown very rapidly.

Building from the experiences of the last few months and

working out from the campus gardens to the larger field of the whole state our vision is this, (1) through a traveling instructor and supervisor to organize California Junior Gardening Clubs until at least 3,000 children are enrolled in a great University class, (2) to work out a co-operative marketing plan whereby local merchants will handle each club's output, (3) to organize banks in each school that the economic pull may give momentum to the work, (4) to interest the gardeners in setting aside a portion of their vegetables and flowers for the poor of their vicinity at Thanksgiving time, (5) to hold annual state vegetable dinners in Berkeley with Gardening delegates in attendance, (6) and lastly a big class of children growing with their plants and looking toward the University and the country at least twice a month.

To make the vision real we shall have Mr. Morse of the Morse Seed Company giving his support, Mr. Bohannan, editor of the Town & Country Journal, opening a medium through which the parents may be reached, Superintendent of Public Instruction, Mr. Hyatt, pointing the way to the teachers. And all in all the immense potentiality of the children will be increased and they will constitute a driving power for good in this state which cannot be denied.

The Civic Aspect of School Gardens

Louise Klein Miller.

Curator of School Gardens, Cleveland.

The civic problem for every community to solve, is to provide for its various gardens of society those living conditions which will minister to their highest physical, mental, moral and spiritual well being.

The thinking men and women of today are demanding the elimination of those forces which tend to the deterioration and degradation of society, substituting those elements which will elevate each member of the community into a higher, clearer, more wholesome atmosphere.

Men, women and children cannot be well as long as their home conditions are exposed to disease breeding and fly breeding streets, alleys and back yards. A man cannot be moral on an empty stomach. Dyspepsia is not conducive to the highest moral and spiritual growth.

Thousands of persons are victims of tuberculosis because of congested and unwholesome home and working conditions. The associated charities annually expend millions of dollars to alleviate suffering and want. Sanatoriums and jails are filled with persons who would be leading wholesome, moral, useful lives. "Bad boys" in reform schools and juvenile courts are victims of misdirected energy. Defective and crippled children are barred from many occupations because of their mental and physical limitations.

Within the borders of every village, town and city in this country there are hundreds of acres of waste and unproductive land in vacant lots, back yards—a civic blemish—which could be made to provide occupation, food, health, and moral and intellectual growth for hundreds who demand and require help for existence.

If the money and energy expended in every community for relief and reformation could be used in constructive work the influence in this country would be overwhelming.

We men and women gathered here today from all sections of the country, representing the most diverse working conditions, have it in our power to alleviate some of the misery and wretchedness of our various communities, and at the same time give a stimulating uplift and impetus to the boys and girls, men and women, who make the back bone of society.

The school garden work as a factor in education has come to stay. Because of its recognized efficiency in the development of the child's whole nature it is rapidly being introduced into the schools. In many instances the cause is espoused by persons whose only claim to success is unbounded enthusiasm. Those of us who have the vision of its educative possibilities must insist upon the work being based upon scientific principles and practice. One of the most important phases of the school garden education is to place the subject before the members of the Boards of Education in such a manner as to secure their co-operation and support. Most of these men and women are like the man from Missouri. You cannot make brick without straw, and you cannot expect to have good gardens without fertile soil, fertilizers and good tools and seeds. These things

should be supplied by Boards of Education as the equipment for manual training, domestic science and art or any other recognized branch of the school curriculum.

Generally school-yard space is not available for school garden purposes, but it is just as necessary and important as a gymnasium or playground. The next best thing is a vacant lot in the neighborhood. Before making a garden the lot must be cleared of rubbish, plowed or spaded, laid out and seeded. These operations are all eagerly and earnestly observed by the neighbors who have been accustomed to see the lot overgrown with weeds. During the summer they are learning the yielding capacity of a small plot of ground. The following year small well-kept gardens may be observed in the whole neighborhood, yielding quantities of good food, affording occupation in the open air, eliminating idle gossip, and possibilities of disease. The school gardens become radiating centers for Civic improvement, and, established in all sections of the community, may be made of great influence.

The working out of a school garden problem in a city of over half a million is not easy and our results must speak for their establishment.

A Department of School Gardens under the direction of a Curator of School Gardens was unique in school history, and Cleveland was the first to make the experiment. The duties of the Curator are to supervise the school gardens, give lectures in the schools, inspect flower shows, arrange for the Autumn Festivals and improve all school grounds. We have school gardens for normal children, backward and defective children, blind children, crippled and tubercular children, boys in the Detention School for Juvenile Court, a kitchen garden for the Domestic Science Class and a botanic garden.

There are one hundred and seven schools with yards varying from one to five acres. Sixty illustrated lectures were given in the schools last winter by the Curator of School Gardens, giving the children specific directions for preparation of soil, fertilizers, planning, planting, succession of crops and blooming, life histories of injurious insects, habits of birds that keep them in check, common weeds, etc.

If such work could be inaugurated in every city, town and village, a wave of civic betterment and mental and moral uplift would sweep over the country which would be of tremendous economic and social influence.

RITTENHOUSE SCHOOL GARDEN, LINCOLN CO., CANADA.
CUT LOANED BY S. B. MCCREADY, GUELPH, ONT.

Book Reviews

The Lure of the Garden. Hildegarde Hawthorne. Quarto. 259 pp. 48 full page plates, 16 in color. The Century Co. $4.50.

In these winter days when the garden lover must, perforce, spend his spare moments in anticipation or rumination, this book is a delightful companion of the long evenings and the open fire. The subject, the author, and publisher have conspired to produce an exquisite volume. Open where you will, you are charmed with the text and fascinated with the quaint illustrations. The Chapter headings are:

Our Grandmothers' Gardens; Childhood in the Garden; Gardens and Groups; Garden Gates; Washington's Garden; Winter Wonder; The Social Side of Gardens; Gardens of Some Well-known People; Gardens in Literature; Some Garden Vices; Gardens Public and Botanical.

"Some Garden Vices" struck my fancy, perhaps through sympathy, possibly from the apparent impossibility of the thing, and I turned to this chapter to begin my reading. The lure of the book led me on until I had read it all. But a sample of that first dip into the pages is an excellent specimen of the author's charm:

"Even the mildest and best-behaved of gardens is liable to sudden lapses, to hideous indulgences. Sometimes you are tempted to believe that only the gardener is ever aware of the power and the omnipresence of evil. Some gardens simply turn lazy. Encourage them, prod them, feed them, and water them as you will, they retain an obstinate inertness. They grow nothing, they do nothing, they gape shamelessly in your face throughout the radiant summer. Or else they turn to weeds. Weeds are, of course, a constant temptation to gardens, even those of the strongest character and finest manners. Hardly any garden but will devote twice the time and trouble to raising some particularly ugly weed than it can be induced to bestow on the upbringing of your loveliest annuals or most carefully cherished perennials. Human mothers are said often to prefer their misformed or wayward children to the good and beautiful ones. Gardens reveal this trait to a dismaying extent. The pity and love shown to its ugliest weed by the average garden is touching, if it were not so infuriating."

As a whole, the book must certainly be accorded a conspicuous place on any shelf of garden literature, and will, I fancy, maintain a position of prestige for years to come.

A Practical Course in Botany, With Especial Reference to its Bearings on Agriculture, Economics, and Sanitation, by E. F. Andrews, with editorial revision by Francis E. Lloyd. pp. IX+374. American Book Co. $1.25.

Those teachers who are acquainted with Andrews' *Botany All the Year Round* will recognize in this new volume the older book with considerable padding. To those of us who have used the earlier text with good results it seems too bad to bring this revision out under another name, especially since the added material is rather inferior in quality. Some of the additional illustrations are very crude, and some at least of the added text is quite inadequate. To undertake, for instance, to give practical directions for hybridization and a discussion of Mendel's Law all in four pages of text is so evidently impossible that the average teacher would prefer to have the subjects omitted. Plant breeding is given four pages, and the factors in the evolution of species one-half page.

One of the best features of this book, which was also found in the *Botany All the Year Round*, is the practical questions that follow the various chapters. The book is still an excellent Botany, but it is that largely in spite of, rather than because of the additions that have been made. The old-type Botany cannot be transformed, in the reviewer's estimate, into the kind of Botany that the modern demand calls practical, by simply adding some material. The point of view must be changed, and a new text written.

Applied Biology, by M. A. Bigelow and Anna N. Bigelow. pp. XI+583. The Macmillan Co., New York. $1.40.

In the preface of this book the authors state: "In the most liberal interpretation, 'applied biology' must present those facts and ideas of the science which apply to human life in its combined intellectual, aesthetic, economic, and hygienic outlook. * * * In other words, it has been attempted to present the science of biology applied to the daily life of the average intelligent citizen." With this understanding of the term "applied" no fault can be found with the text. One rather expects, however, when he picks up a book with the title so changed from the customary title of a text-book in Biology, to find that the treatment is quite altered. That is not the case with this book, however. It is simply a systematic course in Botany, and Zoölogy, with 100 pages added on Human Physiology. Then there is a brief chapter of

thirteen pages, on evolution and heredity of animals and plants. The text is a very excellent one, the descriptions and laboratory directions being quite in accord with recent results of investigations, and one finds interesting paragraphs on some of the valuable contributions that have been made to human comfort and welfare in recent years from Zoölogy and Botany. Here is a page under "Bacteria," devoted to the nitrogen fixation by certain bacteria of the soil; under "The Simplest Animals" there is a paragraph on the parasite of sleeping sickness, and so, throughout the book, as opportunity offers, information has been added along these lines of recent research. The text is adapted to Freshman college work, or might be used in the later High School years.

Animal Competitors, by Ernest Ingersoll. pp. XII+319. Sturgis & Walton Co., New York. $0.75.

This is one of the series of books edited by Ernest Ingersoll, and known as the Young Farmer's Practical Library. The animal competitors are those animals, principally the rodents, which take toll so extensively of the farmer's crops. There are chapters on the Pest of Rats, the Meadow-mouse and its Mischiefs, Squirrels Good and Bad, Suppression of Rodents as Pests, Foxes and Fox-farming, etc. Altogether it is a very interesting book, and one that the young farmer or young American of any sort will read with interest. The chapters on Poisoning and Trapping and the Suppression of Rodents are sufficiently explicit to be of real use.

Nature Study on the Farm. Soils and Plants. Charles A. Keffer. American Book Co. pp. 154. $0.40.

This book is intended for children of ten to fourteen years of age, and both in point of illustration and in character of the text is much better adapted to instruction in elementary agriculture than many of the more pretentious books that come out under the title of "Agriculture." The illustrations are excellent, and the text is clear. There is a tendency to personification, as if a fourteen-year-old child would not be quite as interested in the purple turnip without calling it a "Miss." The opening pages on the soil and its relations to the plants are particularly good, and the chapters on Ploughing and Cultivation seem clear and easily within the comprehension of the child. The book is in the nature of a supplementary reader, although there are some directions at the close of the book—some twenty pages in all—for practical work.

News and Notes

Tentative Report of Committee of the School Garden Association of America

On Affiliation with the American Nature-Study Society

We believe that affiliation is desirable to the extent of (1) meeting together whenever feasible, (2) having a department devoted to the interests of teachers of school gardening in the NATURE-STUDY REVIEW, and (3) making provision whereby membership in both associations and subscription to the NATURE-STUDY REVIEW can be secured at a lower rate than separate membership in both associations. To bring about these desirable ends we recommend:

1. That arrangements between the American Nature-Study Society and the School Garden Association of America as to programs and places of meeting be entirely informal and left to the presidents of the organizations to arrange.

2. That the NATURE-STUDY REVIEW, which is now devoted largely to the discussion of pedagogical questions, conduct a department on school gardening and an assistant editor be appointed by the School Garden Association of America, to secure and edit the school garden copy.

3. That active membership and annual dues in both organizations, including one subscription to the NATURE-STUDY REVIEW, be fixed at $1.25, to be paid to the treasurer of either organization and by him divided in the ratio of 85 cents to the NATURE-STUDY REVIEW and 40 cents to the School Garden Association.

ERNEST B. BABCOCK,
DICK J. CROSBY,
LOUISE KLEIN MILLER,
Committee.

How may school gardens be financed?

Approach people with means; men and women, public-spirited—or apparently not. Explain to them the necessity for School Gardens and you will be surprised how liberally they extend a helping hand. School entertainments, social gatherings,—anything to cause public sentiment.

Cause a little to be done here, a little there, and a little somewhere else, and in time it will be gathered into a mighty current

of public influence—a Zeitgeist, to use a forcible German word, in favor of School Gardens, and eventually the school authorities must take care of it.

B. J. HORCHEM,
Supt. "Park Life."

What is the chief end of rural school gardens?

Perhaps to put country children more in sympathy with plant life and thus to help make country life more attractive. I am thinking of boys and girls below the high school.

O. G. KERN,
Co. Supt. Winnebago County, Illinois.

How do school gardens help the improvement of school grounds?

They develop in the child a love for flowers and ornamental shrubs, and a knowledge of the cultivation and arrangement of these to beautify unadorned and unsightly spots wherever found. Such training is sure to lead to the improvement of both the home and school grounds.

O. A. MORTON,
Marlboro.

What are the best vegetables for a school garden?

Radishes, peas and potatoes.

F. J. VEASLEE,
Lynn, Mass.

How should teachers prepare for school garden direction?

1st. *Do something!* The start is the hardest part of the problem; join with the children in the school in making home gardens.

2nd. *Do something more!* The second year try a small plot on the school grounds with a few experiments.

3rd. *Keep doing something!* Attend a Summer School at an Agricultural College and make associations with other teachers working in the same cause.

4th. *Keep advancing!* With these experiences as a foundation a teacher is ready for a year's course at an Agricultural College.

S. B. MCCREADY,
Director Elementary Agricultural Education.
Guelph, Ontario.

What are some excellent bulbs for schools?

Hyacinths, Roman for early flowering.
Hyacinths, Dutch for late flowering.
Tulips—Duc Van Thol varieties.

Narcissus. 1. Trumpet varieties—Trumpet Major, Golden Spur.
2. Star varieties—Stella, Sir Watkin.
3. Double varieties—Van Sion, Sulphur, Phoenix, Incomparable.
4. Polyanthus varieties—Paper White.

Freezia (excellent, cheap, need not be stored in dark).

M. CATHERINE STRAITH.

How may churches and public welfare societies take up school gardens?

It may be begun in connection with neighborhood, Sunday School or welfare work at parish or vacation house, using a part of the children's holidays at such houses for garden hours; making the garden privilege a prized right of the children and one infrequently accorded to outsiders. This deepens interest from the start and by limiting the number of plots, increases desire of ownership. Seeds the *first* year should be free. There should be a trained director to plan a garden attractive to visitors of all ages; to coach volunteer assistants, to develop interest in all the life of the garden and its bearing on human life; one who aims to attract all members of the clubs or societies and to bind them into family, or neighborhood groups.

M. LOUISE GREENE.

What are the most successful flowers and shrubs for beautifying school grounds?

For the shady part of the yard, Pussy Willow, Weigelia, Syringa (Philadelphus) and Forsythia have been most successful in the climate of Washington. The Pussy Willow and Forsythia are especially valuable because they may be grown from cuttings by the children and are good nature study material. Privet for hedges is a rapid grower and especially fine for cuttings. All of these shrubs will be much more attractive in the full sunlight. Tulips, hyacinth and narcissus take a foremost place in the spring garden. Zinnias, marigolds, nasturtiums and sweet alyssum require the minimum of attention and so add to the success of the school garden. Among the vines, clematis, paniculata, cinnamon vine and purple flowering bean live through hot summers and withstand insect attacks.

SUSAN B. SIPE.

What plants are most successfully grown by Kindergarten children?

In our garden the best results have been with corn, zinnia, mignonette, marigolds, morning glory, four o'clocks and yards of pumpkin vine, but no pumpkins. The radishes too have been very successful. LUCY E. GILBERT.

Some articles dealing with Nature Study subjects in recent magazines, January 1912:

Scribner's, "The Sheep of the Desert." Kermit Roosevelt.

Century, "Across South America—Through the Rubber Country." Charles Johnson Post.

St. Nicholas, "A February Freshet." Dallas Lore Sharp. "Nature and Science." Edward F. Bigelow.

World's Work, "The Potash Search in America." Guy Elliott Mitchell. DELIA I. GRIFFIN.

Problems in the Experimental Pedagogy of Elementary Agriculture. G. A. Bricker, Journal of Educational Psychology.

Pedagogical Problems in Nature-Study. F. L. Holtz. Ibid December, 1911.

W. L. Oswald, whose article on "Seed Testing" appeared in the January number, is connected with the Agricultural College of the University of Minnesota, and not the University of Michigan, as was stated under the title of his paper.

Miss Ruth Marshall, Ph. D., Professor of Biology at Rockford College, Rockford, Ill., is announcing several nature lectures. We are in receipt of a similar announcement from H. D. Hemenway, Northampton, Massachusetts.

C. J. Abbott's "Home-Life of the Osprey" can be obtained in this country at Brentano's, 229 5th Ave., New York City, $2.00. This book was reviewed in the January number.

Mr. and Mrs. F. L. Stevens, together with several members of the faculty of the new Porto Rico Normal School, sailed the first Saturday in the new year for Porto Rico. The party included R. I. Smith, of the Raleigh, North Carolina, Experiment Station, who will have charge of the extension work; Mr. Arthur D. Cromwell, of Humboldt College, Iowa; Mr. B. T. Griswold, of the College Agricultural Station, Texas; S. K. White, Ames, Iowa; A. E. Cockefair, Cape Girardeau Normal School, Missouri; and Miss May Umberger, Calumet, Michigan. Mrs. Stevens will have charge of the Domestic Science work, and Mr.

Stevens is President of the new agricultural college of Porto Rico. They will conduct extension work in connection with school work on a large scale, aiming to familiarize the natives with modern methods of agriculture. For this purpose they are taking moving picture machines, as well as ordinary stereopticons with abundance of slides.

THE NATURE-STUDY REVIEW wishes Mr. Stevens abundant success in this large attempt to give nature instruction, and expects to be able to present reports later on from him regarding the progress of the undertaking.

A reception and luncheon will be tendered U. S. Commissioner of Education P. P. Claxton at St. Louis, February 26. This is in connection with the meeting of the Superintendents. The subject of Dr. Claxton's address will be "The Relation of the Federal Government to Education and the Interest of the Nation in Education for Service." The program of the Superintendents' meeting has in it some exceedingly interesting papers on elementary agriculture in the schools and similar topics with nature-study bearing. It is an opportunity to hear some spirited discussions along these lines and to honor Dr. Claxton, whom we all admire and desire to support. Seats for the luncheon may be obtained from E. E. Balcomb, Greensboro, N. C.

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Mr. Elliot R. Downing, Editor,
The Nature-Study Review,
The University of Chicago, The School of Education,
Chicago, Ill.

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Signed .....,

.....Street,

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Date .....

Mr. Elliot R. Downing, Editor,
The Nature-Study Review,
The University of Chicago, The School of Education,
Chicago, Ill.

Dear Sir:

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OFFICIAL ORGAN OF

AMERICAN NATURE-STUDY SOCIETY

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VOL. 8 MARCH, 1912 NO. 3

Pedagogy of Secondary School Agriculture

L. D. COFFMAN.

University of Illinois.

A Critical Examination of the Pedagogical Conditions and Principles Involved in the Introduction of Agriculture into the Secondary Schools.

It is assumed that we are not concerned with the question of whether agriculture shall be introduced into the secondary schools. That it is introduced or is to be introduced is regarded as an assumed fact. We therefore are not concerned with any propaganda for creating a favorable public opinion for it. We concede that public opinion has already registered itself in securing the introduction of the new subject.

There are still other questions and problems that are necessarily eliminated from our discussion this afternoon by the title given to this paper. I refer to the historical aspects of the movement, to the scope and analysis of the field, and to the character and amount of agricultural instruction to be given in the elementary schools, in normal schools and in colleges and universities.

Any attempt to describe the conditions in the high schools of this and of other states with reference to the teaching of agriculture, should be based upon a quantitative study of the situation.* As there was not much time in which to do this, no ad-

*A very satisfactory and somewhat recent quantitative and comparative study of agriculture in the secondary schools of this country will be found in Dr. Clarence Robinson's thesis, published by Teachers' College.

equate account can be given. However, there are a few things that are perfectly obvious. One is that no attempt should be made to introduce agriculture as a separate subject without first having made adequate provision in the way of equipment. A short-handed or a short-sighted policy with reference to this matter would likely defeat the very ends for which the advocates of the subject have been arguing. No mere dabbling in the field will suffice. The proper library equipment and laboratory facilities are imperative if agriculture is to be dignified as a subject.

There should be no beginning until the beginning can be made satisfactorily. Some think that we should introduce the work gradually, a little this year and a little more next year. This is a good administrative principle, provided the conditions in the high school, such as the number of students desiring it, and the finances of the community demand it, and provided it is not disguised under some assumed name. It is this latter attitude that superintendents sometimes foolishly think wise. They delight in dropping the disguise after so much of the people's money has been surreptitiously invested, that it would be difficult to retract. Of course, it is just as vicious to attempt a large beginning with a lot of unnecessary apparatus. In every case the beginning should be adjusted to local needs, a sufficient amount of proper equipment should be purchased, and the materials of the subject should not be obscured under a fictitious representation.

Another condition that handicaps the secondary schools and militates against efficiency in instruction in agriculture, is that of securing competent, well-trained teachers. On account of the newness of agricultural colleges but few people have been trained, and many of these have become teachers in other colleges or have gone out to try their hands at practical scientific farming. As a result, the high school administrator has few or none to select from. Until this condition is remedied we cannot expect instruction in agriculture to spread rapidly nor can we expect the secondary teachers of it to be in high repute with the teachers of the other sciences.

A third condition is found in the attitude of the high school teaching force to the new subject. There is a lack of interest and enthusiasm for it on the part of many of the older teachers. This, however, is not strange. No new subject has ever been welcomed by them. They usually bestow their greatest affection upon the oldest subjects. Nevertheless their indifference, although at times it constitutes a valuable check upon radical schemes and the imposition of fads, makes it difficult for agriculture to se-

cure early a permanent foothold in the curriculum. It is largely for this reason that agricultural schools have tended to spring up independently.

The fourth and last condition that I shall mention is the necessity of having the subject more clearly defined. I understand that there is no satisfactory textbook for secondary schools on agriculture, that those that are in use treat limited aspects of the field in a limited way, and that the terminology and facts used frequently do not meet the approval of expert scientists. If there was a more definite limitation of the field, if proper equipment was secured, if efficient and scholarly teachers were at hand, and if the present high school force warmly welcomed the new subject, there would be no need for this meeting nor for any attempt at a statement of principles.

You are no doubt more interested in the principles than you are in the conditions that affect the teaching of agriculture. The conditions are being met and satisfactorily disposed of every day, but the educational philosophy and principles that limit the instruction are not as yet fully agreed upon. The principles to which I wish to call your attention apply with equal force to the teaching of every vocational subject. As a basis for the application of the principles to the specific problems of agriculture in the high schools, I wish in the first place to discuss rather abstractly a few of the generalizations of the current philosophy of education that apply to the curriculum in general.

It is an obvious fact that no curriculum can remain static. As social and industrial life undergo modifications there will be corresponding shifts in the materials of education. The modification of the curriculum, in other words, is the direct result of modifications in social and industrial life. Every modification of a school curriculum is simply an administrative attempt at conscious adjustment.

Furthermore the changes that are occurring in the world outside the schools are the result of, and in turn result in the multiplication of human wants and needs. Some of these needs are transient; they last but a season. Those that are fundamental to the life of the people—and the tests of whether they are fundamental or not are to be found in the degree with which they persist, the extent of the spread of their practice and the number of human beings who find their struggle for existence or for abundance, i. e. for a mere livelihood or for culture and ease, consequently lightened—those, I say that are fundamental to the life of the people, will sooner or later result in a new mode of action.

a new method of control, a new occupation. There will be a new skill or culture to be transmitted. Now by common consent the agent of conscious education, the institution that must transmit this new skill or culture is the public school. It is no longer some form of apprenticeship. Sooner or later pressure will be brought to bear upon the school for the transmission of the new skill or for the cultivation of an appreciation for the new culture.

Subjects of study are born out of the stresses and strains that the race has made at attempts at environmental adjustment. The adjustment geography would have us make is not the same that physiology would have us make. The adjustment one vocational subject would have us make is not the same that any other vocational subject would have us make. Each subject represents a unique environment control. Each functions in conduct, but in its characteristic way. Some train in valuable habits, others give possession of useful information, still others inculcate the priceless ideals and spiritual inheritances of the race, and all give methods of work or attitudes toward life.

It is clear that the need for some adjustments disappears with time and that subject or phase of a subject that has been utilized to train one to make this adjustment is dropped from the list of school materials. It is true also, that some things are retained long after they have ceased to be useful, but it is because the traditional habits of the schoolmaster leads him to believe that they are still socially serviceable.

We know that for centuries educational processes were carried on more or less unconsciously by the race; at least there was no purposeful program. The aim in every case, no matter how small the group, has been that of active participation in the practices and functions of the group, which practices and functions were but the expressions of the needs and ideals of the group. Every subject of study passed through a long preconscious period before it arrived at the point of conscious formulation. Even after it was once formulated its evolution did not cease; it continued to be altered to meet changing social conditions. Before the needs and ideals became defined and assumed a more static character they were experienced as mere feelings, dim wants or impulses. As efforts increased to define these feelings, to satisfy these wants, to express these impulses, through the operation of the principle of selection, a mode of action or a subject of study became proportionally defined. Professor Dewey commented upon this as follows: "The race has found certain things worth

controlling, and has devised methods of control, ways of acting which will give us control. These things we call subject-matter and some of the best of them have been selected and put into books to be taught to children, so that they will not have to learn at first hand as the race has done."

Perhaps you may be asking what this rather lengthy analysis has to do with the question in hand. The answer is not far nor hard to find. A study of the history of agriculture shows that it has experienced the self-same evolution that has characterized every other subject. For years its principles and methods have been more or less consciously transmitted. As a result of changed social and economic conditions, the followers of agriculture and many who are intimately dependent upon it became aware of certain serious maladjustments in its practice. And as a consequence from somewhat different sources pressure has been brought and is being brought to bear upon the schools to provide instruction in agriculture. This pressure is but another specific illustration of the intimacy of relation between social forces and the school.

One of the interesting generalizations of the history of education and of educational sociology bearing upon this is that the public schools have in recent times at least never taken on a new subject of their own initiative, that is without being solicited or coerced to do so. It is for this very reason that new types of schools are constantly springing into existence under the guidance of agencies or groups of people not connected with the established school system. The very existence of any new type of school under non-public school control is prima facie evidence of the failure of the old types of school to meet the needs of those who attend the new school. The only schools that are being rapidly deserted by their constituencies are those that have lost their plasticity or flexibility and are unwilling to be modified so as to satisfy the newer demands. The implication of this principle is that if agricultural high schools are fostered and maintained here and there by commercial organizations, grange societies, or by any other sort of private or collective endeavor other than that lodged in the present public schools,—it is a reflection upon the leadership of the public schools. It shows that the leaders are not always sufficiently sensitive to community progress and that they are, in many cases at least, so encrusted by conservatism as to impair their general efficiency. Even when they do take up the new subject and put it into their old type of schools, there is a very grave danger that it will lose its distinc-

tive character and fail in its rightful influence because of their failure to adjust themselves to it; rather are they disposed to refract and bend it to correspond to their traditional practices.

It must have been observed that I have not attempted to justify the existence of any subject on the ground of its mind training value. And yet, this is the very thing the schoolmaster usually resorts to when he defends or argues for the retention of the new subject after it has been forced upon him. The explosion of the doctrine of formal discipline has removed from many a schoolmaster his pedagogical safeguard; it will no longer serve as a kind of final cause for determining the educational value of subject matter.

It was contended by our educational forbears that training in accuracy in one field meant an equal amount of training in accuracy in every field, that training in observation in one field meant an equal amount of training in observation in every field; in other words the reasoning ability one had trained through the study of mathematics made him therefore a correspondingly better reasoner in theology, and the training in memory one got by the study of language made him therefore a correspondingly better memorizer of dates in history. Under this theory specialized skills were generalized so as to have universal application.

No one who is thoroughly informed in regard to the recent investigations in educational psychology will assert that subjects are intended to train particular faculties, that the training one receives in accuracy in observation, or in memory in one field necessarily means an equal amount in another field. Indeed, we know that training in one field means no training at all in dissimilar fields. This does not mean that the mind is not to be trained. The mind *is* to be trained, but in those habits, modes of behavior, methods of work, appreciations, and it is to secure possession of that knowledge that will be of the greatest social service to it. A few studies or a few situations will not accomplish this result; a variety of studies and situations—hence the enrichment of the curriculum—are needed. Formal discipline and social utility are thus seen to be but separate ends of the same problem.

All this means that a new and heavier responsibility is placed upon the teachers of the present generation than upon the teachers of the past generation. It is their business to give training in those subjects that are of the greatest environmental importance. This old question, "What knowledge is of the most worth" has now been answered. "These subjects are of the

greatest educational value which have the greatest number of identical situations with life." Facts apart from that environment which gives them value are not significant. There is much ignorant teaching because teachers do not know or see school studies growing out of and functioning in environmental relations. School work is thorough when it has functional significance in life outside the school. Those elements of subject-matter that are repeated over and over and over in the environment outside are the most important for the school.

Partial critics may say that in this program and statement of principles, I have ignored the distinctively cultural phases of education. To these I would reply with our Director of Education here at the University that "intrinsically useful materials may just as successfully form the basis for the development of ideals as intrinsically useless materials. That the student of engineering or agriculture or commerce does not always acquire the ideals that mark the cultured and refined 'gentleman' is not the fault of the subject matter, but rather of the method." It is almost if not quite an educational truism that the mastery of useless materials leads to mechanical memorizing, while the mastery of useful materials because of their consequent greater concreteness leads to the development of serviceable ideals and attitudes. And again, I would reply that utility is not used in any narrow bread and butter sense, but rather in the sense of social service. Social service clearly demands vocational efficiency, training in which is becoming more and more one of the distinctive problems of the secondary schools. It also demands that training which affords ideals and standards for achievement and social betterment and which provides those cultures and refinements that are the sources of comfort and pleasure during the distinctively leisure periods of life. It is this latter aspect that I sometimes fear we are neglecting in our mad haste to completely vocationalize the high schools. Any definition of utility that fails to take all of these into consideration is inadequate.

Now so far as my reading and observations go, none of the critics or advocates deny the validity and application of the foregoing arguments to agriculture. It trains in a large number of habits and gives possession of much information that is now more than ever imperiously demanded. The demand for such training and instruction is indicated (1) in the drift of rural population from country to city, (2) in the rapid increase of tenant farmers, and (3) in the per cent of increase of consumption over the per

cent of increase of production of the agricultural products in America.

Another principle which every public school administrator takes cognizance of today is that the individual and the community do not require the same thing. The enrichment of the course of study has been due both to outside requirements and to a recognition of individual differences. Because people vary by nature as to abilities we have provided them in the curriculum with a greater variety of appeals. But no individual responds to all of these appeals nor was it intended that he should. A community is made up of different kinds of people and consequently of different occupations and vocations. No one any more attempts to practice them all. "What is one man's vocation is another's avocation, and what is technical and professional to one is humanistic to another." Specialization in occupational life has its counterpart in the differentiation of materials in educational procedure. The high school is therefore obviously devoted to the problem of differentiating students according to their special talents and this occurs largely as a result of the opportunities afforded for selection by the modern curriculum.

The course of study required by a community is necessarily far broader and contains more materials and subjects than that required by an individual. The individual is restricted to a single vocation and to those common cultural possessions that make him an agreeable citizen and a supporter of the best in our institutional life. Any theorist, therefore, that argues that all pupils alike must take agriculture or any other distinctively vocational subject is flying in the face of the known facts of modern psychology and sociology.

Just what shall be the place of agriculture in the school, I find to be still somewhat a matter of dispute. The agriculturalists claim that it shall have a recognized place on the regular program, but some of the teachers of science hold that no such recognition is necessary. They both assert that some instruction in the field is imperative. The practical school man who has little technical knowledge of either field is called upon to arbitrate the discussion; and after all he is the one who in the long run must settle it, but it is hardly likely that he will ever settle it so as to meet the full approval of each of the contending camps. However, in his opinion the recognition that should be given to the subject may be briefed as follows: Agriculture should not be a smattering of botany, of zoölogy, of chemistry and of climatology. Nor is it held in solution, so to speak, in nature-study and

geography. We cannot dip into the natural sciences and take out a piece here and another piece there and make them the separate chapters of a science of agriculture. No science ever grew or was ever organized in that way. It is true that each of these sciences affords many opportunities for the teaching of many agricultural facts, but that does not mean when they have been thus taught that one has a science of agriculture. The teaching of agriculture through all of the sciences would probably mean that it would be done by individual specialists in a haphazard manner. At least the primary facts of agriculture would not be organized with reference to its purposes. No university or college has as yet demonstrated that it can satisfactorily carry out such a scheme. If it has not succeeded in these higher institutions what can we expect of it in the high schools where the teachers of the various sciences have a much more limited training?

The difficulty with which we are confronted in our high schools may be made clear by a personal illustration. As a superintendent of a city school system a few years ago it was my misfortune to be compelled to secure a teacher of botany for each of three consecutive years. The first was a student of the histology of plants. We bought him a number of compound microscopes and supplied him with an abundance of text-books and supplementary materials. His students made beautiful drawings of the slides they prepared under his tuition for the microscopes. They learned the minute structure of many of the forms of plant life of that region.

The second teacher knew nothing about this phase of botany. He had specialized on trees. So we purchased a number of Apgar's Manual of Trees and such other supplementary books as he wanted. We rearranged our program so as to make it possible for him to take his class into the forests round about. The students learned the names of the trees and the families to which they belonged. In the meantime our valuable miscropes remained throughout the year carefully stored away in a glass case.

The third year we had a man whose information about the histology of plants or the study of trees was too meagre to enable him to teach either of those phases of botany. He was a systemist. He taught his class how to classify all sorts of plants. They carried into the laboratory leaf after leaf, and plant after plant, and by the use of a manual each of these was carefully traced down until its correct Latin name could be given, after which it was pressed, put in the herbarium and properly labelled.

Apgar's Manual of Trees and our compound microscopes were kept in as good condition as possible for we were not sure what sort of a prodigy we might have to teach our science the next year.

This illustration is not overdrawn in the slightest degree. One danger of much of the modern science teaching has been extreme specialization, and that specialization has occurred altogether too frequently before the student has acquired any adequate knowledge of the fundamentals of any field. It is for this reason that I hold that it will not do to leave agriculture to be taught incidentally by the scientists. The high school principals and the superintendents know this and they will not readily accede to a condition that in the light of their experience means failure.

It is sometimes urged that it makes little difference where facts are taught just so they are taught. And it is also urged that the method with which they are taught makes no difference. This is equivalent to saying that if all the facts of agriculture are taught in the teaching of the various sciences that there will be no need of agriculture having any place on the program. My first objection to this is that the facts *will not be taught with reference to agriculture;* they will not be organized in the light of its needs. Whatever organization there is will be of a purely hit or miss sort. My second objection is that many of the important facts of agriculture will not be taught. The other sciences do not provide for instruction in farm machinery, stock judging, corn judging, the selection of seeds, etc. My third objection is that facts taught with a certain purpose in mind are not necessarily readily transferable to another field, even though it be a closely related field. Without conscious organization vital relationships are likely to be missed. Either agriculture is or is not worthy of a place on the program, and if it is, then the facts and methods that constitute its special field are the ones to be emphasized.

We are not to infer from the preceding remarks that the teacher of agriculture will need to know no science. Indeed, he will, he must be thoroughly grounded in the elementary principles of science and especially well informed in all those phases that have a special bearing upon his field. The leading teachers in agriculture will be thorough scientists. There is no other possible way for them to advance their field. It is not with this phase of the problem, however, that I am so much concerned as I am with the fact that a science is never developed through the

reorganization of other sciences. It can only be developed by the application of scientific principles to the facts in its own field. The principles of agriculture will be deduced and organized and applied through the study of the chemistry and productivity of different types of soils, the culture of certain forms of plant life, animal husbandry and the like. With some of these the botanist would have no concern; with others, the zoölogist, and with still others, the climatologist. Moreover the botanist would be interested in a multitude of facts and phenomena that would have but a passing interest for the agriculturalist. Even if they were to take the same fact for study, it is not altogether improbable that there would be a somewhat noticeable difference in treatment because of a difference in point of view.

Apparently, it has been assumed in some quarters that the scholarly and expert botanist will therefore be an equally skillful agriculturalist, and that this principle holds true for the teachers of each of the other sciences. Such a thing may occur. Of course, there is some transfer of knowledge, of skill, and of power, from one of these fields to each of the others, but the correlation, although positive, is far less, I believe, than we are disposed to suspect. The transfer occurs only when the facts are alike or when the methods are similar. If the correlation of degree of relationship were perfect we should need no study of agriculture; it would already have been taken care of by the other sciences. If one wishes the habits and knowledge that correspond to any field, those that really make it unique and distinguish it from all other fields, he can secure them only by studying the facts and processes that belong to that field.

It will be noted that throughout the discussion of the last principle, I have implied that agriculture is both an art and a science. That it is an art requires no discussion as it has been practiced for centuries; that it is a science is a fact that its advocates are trying to demonstrate. In the secondary schools shall we emphasize it as an art or as a science? Or shall the two phases be given equal emphasis? To my mind it will never be rational to emphasize the art side to the serious neglect of the science side, nor will it ever be rational to emphasize the science side to the utter neglect of the art side. If either *must* be neglected in the school, I am convinced that it is better to teach agriculture without emphasizing its technique than it is to teach it without emphasizing its content. An illustration from another field will make clear what I mean. Some time ago it was my privilege to visit one of the best schools in this country for the

training of manual art teachers. Accompanying me was a man who had devoted years to the study of this problem, who not only knew it in its manifold applications, but who was a skilled technician himself. We found on display the work that the students had made during the year. In the main the articles exhibited were simple household articles of furniture. The students seemed to take no small amount of pride in showing us about and in calling our attention to their tools, their benches, and their products. My friend inquired with interest as to their more intimate knowledge of the kinds of wood, their relative abundance, their respective locations, their market value, the methods employed in curing and preventing them, and the various commercial uses to which they might be put. Strange as it may seem, those students were dreadfully deficient on this side of their work. They had acquired a technique, they were masters of the skill, but they had no familiarity with the content side. They knew the art but not the science of manual training. This is the ever present danger in the teaching of any vocational subject. In our great haste for application and for immediate tangible results, we may neglect that broad foundation which makes technique meaningful. The elimination of the so-called impractical invariably results in the inefficient functioning of the remainder. The very highest and by far the most practical results will be secured in teaching the science of agriculture instead of teaching the art of agriculture. One may be able to teach agriculture without knowing how to harness a horse, to milk a cow, or to bind grain. It is time that we had ceased sneering at the more purely scientific aspect of this subject, and of others, for that matter. Pure science always leads to practical science, and the present generation undoubtedly needs a greater respect for it.

However, we must remember that the "literature of agriculture should never divorce the pupil from actual and sympathetic contact with the materials of education." Laboratories and experiment stations will not be permitted to remain idle. My plea is that the art of agriculture be practiced more scientifically and I hold that this can best be accomplished by placing the primary and predominating emphasis upon the scientific side so that every prospective farmer who graduates from our schools will be equipped with the scientific method.

I must leave other principles of interest for your discussion. Nothing has been said about the motives agriculture supplies for work, about the adaptation of the material to local needs, about the futility of attempting to popularize such a course in all high

schools, city and country alike. Nor about the emotional attitudes toward farming agricultural instruction should cultivate. It was merely my purpose to call your attention to some of the more fundamental considerations. In connection with the considerations and principles outlined in this paper, it is well to remember that all the efforts towards the introduction of agriculture are but a part of a larger movement in education. It is our business to catch the spirit of this larger movement in education which is trying to adjust our education to a progressive civilization, a movement in which true culture expresses itself in real service to humanity.

Nature-Study and the "Garbage Barrel"

ERNEST B. BABCOCK.

University of California.

A western journal of education is publishing a series of articles from California educators on "Contributions to the Educational Garbage Barrel." From the standpoint of one actively interested in teaching nature-study and agriculture in our public schools, the educational garbage barrel is an alluring subject. It is still a difficult matter to arrange for two hours per week out of the regular sessions for such intrinsically valuable work as gardening, while nature-study as a subject is not yet incorporated as a vital part of our school life. I believe in nature-study for the lower grades and nature-study-agriculture for the upper elementary grades, with gardening as a basic activity throughout the whole. But, alas, we are always confronted by the "already overcrowded curriculum." I must confess to a lively curiosity, therefore, to know the opinion of others as to what can profitably be eliminated from the other subjects.

We must be willing to make some concessions in an effort of this sort, so I will leave the decision as to the relative merits of partial payments and participial infinitives to those who are more competent to choose or eliminate. Agriculture as a subject for the seventh or eighth grade gives promise of future value. "Nature-Study leading to Agriculture" is authorized as an oral subject by the State Law of California, but the nearest approximation we yet have to this fortunately worded combination is found in the scattered efforts to teach nature-study on the one hand and the reading of supplementary agriculture texts on the

other. There is no attempt at connection between the two and the so-called agriculture is seldom vitalized by illustration, demonstration or experiment. The eastern texts now in use are out of place in California elementary schools. Fortunately for our grammar grade boys and girls we have a new text on agriculture for schools of the Pacific Slope, written by California men. It is rich in suggestions for observation and experiment on the part of the pupils. But even this will fail to secure ideal handling of the subject unless teachers plan for garden work to furnish outdoor experiment and application of the principles studied.

Nature-Study can hardly be said to give such definite promise as agriculture. We have been blessed with some very elaborate plans for nature-study in large cities where, so far as I can learn, very little nature-study is taught, as yet. We do not need more scattered efforts giving more detailed suggestions until we can agree upon certain well proved units which may be united into a progressive minimum course that is capable of being expanded according to the desires and qualifications of individual teachers. New York teachers are striving for this and it is what we should seek. Then a teacher would know what was expected of her and could economize her time in preparation, which would include a study of the school's environment with reference to the subject in hand, the selection of material and some thought about methods. One of the great needs of California schools to-day is organized nature-study. Certainly, "our work and the world's work have not been along parallel lines," but nature-study properly introduced can help overcome the deadening effect of this lack of connection of school with life for both teachers and pupils.

Enough has been said about "so-called" nature-study. We could not put Nature in the garbage barrel even if we wanted to, but we can easily get along without many of the supplementary science and nature readers when we take time for real nature-study. We should not strive to limit the proper use of the imagination, but we should shun the wholesale personification of natural objects. Notwithstanding the aesthetic and ethical values of nature-study, we should not turn a deaf ear to the farmer, who calls for "more about potato bugs and less of pussy willow." Where nature-study has been taught the longest in this country, the tendency now, even in the primary grades, is to select the concrete, the practical, the thing that is of some use to the child. Especially toward the close of the period of boyhood and girlhood and the dawning of early adolescence, we should have the

intensive study of certain natural groups—trees, birds, crop plants, insects, bacteria—in their relation to man, for about this time man is supplanting nature as the center of education.

As for the daily selection of material and methods of presentation—this must be worked out by the individual teacher in her local environment and it is in this connection that the point of view is so important. What is fit for the "garbage barrel" in the hands of one teacher may be invaluable as treated by another with a different view point, a broader horizon, a truer conception of what the school should do for the child. Hence, no matter how many examples are cited of nature-study that is fit for the "garbage barrel," let us remember that it is not the fault of the subject taught but rather it is the teacher who is responsible for wise use of her own and her pupils' time.

Varieties of Radishes

EMILY BENOIT.

A Student's Garden Report.

The purpose of this experiment was to find out what radishes were the best for use in a school garden of the vicinity. The experiment was tried in Bloomfield, N. J., in connection with the school garden work in the Nature-Study department of the state Normal School at Upper Montclair, New Jersey.

I. VARIETIES, 10.

James Vick's seeds.

a—French breakfast, or scarlet olive shaped white tip.
b—Extra early scarlet turnip-rooted.
c—White turnip.
d—Early round dark red.
e—Vick's early scarlet globe.
f—Turnip (red).
g—Scarlet olive-shaped.
h—Philadelphia white box.
i—Vick's all season.
j—Scarlet turnip white tip (rosy gem).

II. PLANTING.

On April 8th the ground was dug and freed from stones, then well manured and allowed to stand until April 15th.

On April 15th the garden was marked off into 10 rows, 2 feet long and one foot apart. The seeds were put into the ground about $\frac{1}{4}$ inch apart and $\frac{1}{2}$ inch deep. The order of the rows corresponded with the varieties given in section I above.

III. Observation on Growth.

Row	Varieties	Appearance	Growth April 26th	Growth May 1st	Time of maturity
a	French breakfast or Scarlet olive shaped white tip.	April 24th	$\frac{1}{2}$ inch	1 inch	20th of May
b	Extra early scarlet turnip.	April 25th	$\frac{1}{2}$ inch	1 inch	20th of May
c	White turnip.	April 25th	$\frac{1}{4}$ inch	$1\frac{1}{2}$ inch	24th of May
d	Early round dark red.	April 24th	$\frac{1}{2}$ inch	1 inch	20th of May
e	Vick's early scarlet globe.	April 24th	$\frac{1}{2}$ inch	1 inch	20th of May
f	Turnip (red).	April 25th	$\frac{1}{2}$ inch	1 inch	24th of May
g	Scarlet olive shaped	April 25th	$\frac{1}{4}$ inch	1 inch	24th of May
h	Philadelphia white box.	April 25th	$\frac{1}{4}$ inch	1 inch	20th of May
i	Vick's all season.	April 25th	$\frac{3}{4}$ inch	$1\frac{1}{2}$ inch	did not mature
j	Scarlet turnip white tip (rosy gem).	April 24th	$\frac{1}{2}$ inch	$1\frac{1}{2}$ inch	24th of May

IV. Results.

a—French breakfast. Long, oval shaped; split roots; white tip scarcely noticeable; pithy and very pungent. Radishes were of different sizes.

b—Extra early scarlet. Round in shape; very hot; firm and tough; rather large for selling; nearly all in the row were of the same size.

c—White turnip. Oval shape; firm, yet tender; mild; nearly all of the same size; color, clear white shading to a light green at the top.

d—Early round dark red. Color, deep red; shaped like a turnip; hard, yet sweet; good selling size.

e—Vick's early scarlet globe. Grows small and evenly, firm, tender but pungent, best radish in appearance.

f—Turnip (red). Color variegated, white and red; not firm, not attractive in appearance.

g—Scarlet olive shaped. Hard and pungent and firm, uneven growers.

h—Philadelphia white box. White in color; shaped like a turnip; mild and sweet, yet firm and tender; even in size.

i—Vick's all season. No growth.

j—Scarlet turnip white tip (rosy gem). Exceedingly pungent; hard and firm; good size for selling and very attactive in appearance.

V. Conclusion.

In selecting radishes for a school garden I should say that: Vick's early scarlet globe, and Vick's Philadelphia white box, were the best. Their growth was more even than any of the other radishes and the flavor and texture were much nicer. The child would naturally like an attractive, mild, quickly growing form. Also the time of maturity is earlier, making it possible to have two or even three crops, at intervals of one or two weeks.

Suggestions for Crayfish Study

Margaret W. Taggart.

The fact that so many children are missing their rightful heritage of a speaking acquaintance with the common forms of life about us was emphasized not long ago in a way both amusing and pathetic. As I was coming back from a collecting trip, some children noticed and exclaimed at my net. I stopped and asked them if they would like to see what had been found in the water that cold day. They crowded about eagerly as I held out a bottle with some ordinary brook crayfish in it.

"Who knows what they are?"

"Minnows," came the answer without hesitation. Evidently a minnow was anything that lived in the water.

"Worms?"

Nobody knew. Finally, after an extended examination, one ten-year-old volunteered, "Grasshoppers—they have so many legs." And in my mind's eye I saw a budding systematist.

As has been said so often before, it is a crying shame for children to miss the experience of a bare-foot encounter with a crayfish and all the free out-door life that it symbolizes.

For practical collecting purposes one may distinguish three kinds of crayfish—burrowing species, those that live in streams with muddy bottoms, and the species that are found in clear gravelly streams.

The burrowing species erect their chimneys near streams or in swamps. They are always found near open water but never in it. They may be found near springs where they can reach the water underground. These burrowing species are not so easy to collect as the others even when the chimneys are very plentiful. A shovel is all that is necessary in the way of apparatus.

The crayfish living in streams or shallow ponds with muddy bottoms are usually plentiful and easy to collect, although small in size as a rule. With an ordinary net or even a long handled dipper, I have caught quantities of little ones in an open drainage ditch one could step across. They are usually found in the vegetation along the edge of the ditch and are accessible all the year around, even when the ice has to be broken to reach the water. These are the best specimens for observation on moulting, as they are hardy and young, moulting frequently.

If, however, the nearest stream has a fairly strong current

and a gravelly bottom, a plentiful number of crayfish may be found under the larger stones. The simplest way to collect them in this kind of a location is to stir up the stones with the net handle or boots, and as soon as the water has cleared any number will be crawling about. If the water is turbid from rains or melting snow, as it is apt to be in the spring, when the brook species are laying eggs, and the females, with the attached eggs, are wanted for class work, a great many may be gathered with the aid of a net held across the stream against the bottom, then disturbing them by overturning rocks and stones a short distance upstream. They are very sluggish and easy to collect in cold weather.

As to the aquarium itself, Professor E. A. Andrews, of Johns Hopkins University, has a most interesting article in the NATURE-STUDY REVIEW for December, 1906, on "Keeping and Rearing of Crayfish for Class Use," which contains much valuable information. Crayfish will live for months in ordinary glass aquarium jars, either with or without aquatic plants, although the plants are of advantage in keeping the crayfish in good condition. A convenient aquarium may be made by fastening a piece of cheese cloth over the top of a glass fruit jar into which water to the depth of perhaps two inches has been poured, and then leaning the jar against a support of some kind, tipping it just enough so that the water will not run out. Two or three crayfish, if they are at all large, are sufficient for one jar. The reason for tipping the jar is to enable the crayfish to reach the air if the oxygen supply of the water becomes exhausted or the water becomes foul. The untimely death of those crayfish whose jars are filled with water by the thoughtful small boy who feels that if *he* were crayfish he would like lots of water, will probably occur several times. Experience, however, although a little severe on the crayfish, will probably soon teach that a very few inches of water are sufficient—just enough to cover them and not so much that they cannot expose their gills to the air.

Temperature and light are two other important factors in the keeping of crayfish. They should not be kept warm, as they are much more active and require more food and oxygen and the mortality is much greater. In winter time, placing the aquarium before a window raised a few inches is usually sufficient. A thin coating of ice on the water some cold morning will not hurt them, although not many survive being in water that has been frozen solid. Care must be taken not to expose

them to too much light when they are first brought in, and direct sunlight must be avoided.

There is something fascinating to all of us in watching animals eat. In a zoo the most popular hour is the one when the food is distributed. Crayfish when brought into the laboratory usually refuse food the first few days. Soon, however, an earthworm dangling before them is seized greedily and eaten on the spot. Aquatic plants, earthworms, small crustaceans from the same stream as the crayfish, bits of fresh meat, bread, cracker—in fact, almost anything is taken readily. A varied diet is best. Two or three times a week is often enough to feed them, perhaps too often if they are in a cool place. As soon as they have all stopped eating the water should be changed in order to remove all particles of food and prevent decay. The aquatic plants will have to be renewed often, as the crayfish eat them greedily. However, they are not necessary although advisable.

Crayfish have one deplorable habit—that of cannibalism. However, it is a question whether the blame should not rest upon the careless person who lets them go hungry. Yet even when they seem well fed, if little ones and big ones are kept in the same jar, castastrophes of this sort are very common.

The seasonal life history is not the same for all species, the breeding seasons differing in different species. The rocky brook crayfish (*C. propinquis*) lay their eggs in the spring, but the small crayfish found in the autumn and winter in the mud bottomed streams are probably from autumn broods of other species. The egg laying of this species may be expected in March, and for the benefit of those who may not have Professor E. A. Andrews' article at hand I venture to quote his description of the phenomena.

"In March the females may be put into dishes of running water by themselves, one, or but few, in each dish. The indication that a female Cambarus is likely to lay eggs is that the annulus ventralis shows a white speck or plug projecting from its orifice. And such a female will predict the time it is going to lay by a most noteworthy process of cleansing that goes on several days before the eggs are laid and which should be carefully studied as a purposeful instinct.

"The female about to lay should, preferably, be kept little disturbed and with one corner of the dish screened to give shade.

"The actual laying will, with rare exceptions, take place in the night, and the next morning the pupils may dimly see some hundred of eggs held enclosed in a mass of mucus under the

abdomen. A strange habit exhibited at this period, a rhythmic lying down and rolling over, is not to be interpreted as sickness, but as a necessary part of the complex series of phenomena concerned in the fertilization of the eggs and in their firm fixture to the abdominal appendages of the female. To insure the fertilization and future development of all the eggs it is well to leave the female undisturbed for a couple of days till the mucus is gone and the eggs firmly fastened, each by its own strong stalk.

"From that time on for a term of five to eight weeks, which, according to the temperature, will be necessary to bring the eggs to the hatching period, the crayfish may be lifted out of the water whenever desired and a few eggs removed for closer observation."

The teacher's knowledge of the morphology of the crayfish can be increased, of course, by any textbook in zoölogy. The two sexes are easily distinguished by the greatly modified first abdominal appendages in the male and the *annulus ventralis*, the rounded structure between the last pair of walking legs, on the female. For anyone who cares to compare the different species, the shape of the first abdominal appendages of the male are the most constant characters, although the shape of the rostrum and of the claws are of value. A number of times when collecting I have made the acquaintance of small boys, who were most interested in learning that crayfish had names and could be identified. One day two boys who happened along sorted eighty crayfish into three different species without a mistake after I had explained the distinctive characters of each.

Problems.

1. Digging out a crayfish burrow is an interesting bit of work for energetic boys. The burrows vary greatly in size, depth and shape, and it makes a nice little problem deciding on the factors which determine the matter—such as depth of ground water, size and number of crayfish, kind of soil, etc. Observations may be made on the chimneys if they are at all plentiful. It is not uncommon to find quantities of them, commonly called "snake holes," on a bit of lowland.

2. It is a matter of dispute among investigators whether the chimney is a necessary and invariable part of the burrow, whether (if it be closed at the top) it is closed on purpose or accidentally, and how many crayfish occupy a burrow.

3. If field work can be done it is possible to work out the most effective way of catching crayfish. Since the animal when disturbed usually jumps backward and upward by a violent flex-

ing of its "tail," the easiest way to catch one is to put a net back of it and then annoy it by the hand or boot, when it springs into the net itself.

4. Observations may be made on the methods of locomotion—whether backward or forward, swimming or walking—and what appendages are used in each.

5. How does the crayfish defend itself? Factors suggested might be nocturnal habits, hard covering, habit of hiding under stones, habit of springing up when disturbed, great claws, and so forth.

6. Whether or not crayfish are sensitive to light is easily demonstrated. Cover one side of the vessel containing crayfish and see how quickly they will collect in the shaded area, if not disturbed. A discussion of their natural environment will bring out reasons why this is of advantage to the animal.

7. There is most interesting material for observation in the actual process of eating. Does the crayfish distinguish food by sight or touch? How does it grasp it? How tear it up? Has it jaws? These and other questions will readily suggest themselves to the pupil and can be answered by first hand knowledge.

8. To determine just how the crayfish breathes is another little problem. First, lift a crayfish from the water for a few moments. On returning it to the water air bubbles will come from near the mouth. After observing this, the experiment of putting a little carmine solution or ink near the anterior end of the abdomen of a crayfish held on its back, will show where the water enters and where it leaves the gill chamber. By pulling off the mouth parts of a dead crayfish, the "gill-bailer," a thin, transparent structure on one of the mouth parts, is easily found. Its function is to keep a current of water going through the gills. By cutting away the carapace, or hard outer covering of the dead animal, the gills will be seen and the gill-bailer made out. I have found that a comparison of the crayfish gills and human lungs makes an interesting and efficient illustration for a physiology lesson on the structure and function of the latter.

9. The fact that a crayfish carries its skeleton outside instead of inside, is usually a new idea. When the pupil observes the process of moulting and sees the whole external skeleton shed so that the animal can grow, he has taken one step further toward an appreciation of the wonderful adaptations in nature. The questions naturally arise as to what parts are in the cast-off shell and why the crayfish is soft-shelled at this time.

10. How does a crayfish move its appendages when it walks?

What is the order of movement, or is there any order? How does it swim forward? How backward? How does it turn over if put on its back?

11. What is the function of each of the various appendages? How is it adapted to its particular function?

12. One or both of the great claws is often lacking, or one may be smaller than the other. Children always seem to notice this and raise the question how and why. If small crayfish are used which moult frequently the process of the regeneration of the claws is easily watched and is usually something quite new and wonderful.

13. When the females are found with eggs the pupils can easily find evidences of maternal care in the treatment of the eggs and young.

14. If material is plentiful the children can sort the animals into different piles according to any standards they choose, and at the end it will be found that the only constant characters—the characteristics which separate species and the ones employed by systematists—have been used by the pupils in distinguishing the various kinds.

15. The comparison of crayfish to discover the individual variation in size, color, shape and activity due to sex, environment and other causes, is well worth while when done with understanding or as a means of answering problems that naturally arise.

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Eugenics

H. H. Laughlin.

Eugenics is the science of race improvement through the application of the laws of heredity. In its present aspect it is a new science and is the natural outgrowth of the renaissance of inheritance studies of the last decade.

That persons are vastly different in their innate qualities and talents, and that the different strains within the great peoples of history have varied greatly in their characteristic capacities have been matters of universal observation and comment. The desirability of propagating from the best and of cutting off the supply of the lowest has always been recognized. Caste, war, prejudice, diffidence, a host of social deterrents, and above all the lack of definite understanding and appreciation of the behavior in heredity of special mental and physical traits have prevented the conservation of the best germ-plasms of history.

Eugenic research holds out the hope of removing the last of these causes of race deterioration. Because knowledge of the facts must precede propaganda and legislation, scientific research into the manner of the inheritance of traits is the present Eugenic program in America. Such a program calls for much first hand data. It means that records of the family distribution of definite clean-cut traits must be had,—many, doubtless hundreds, of hu-

man traits must be studied. The kinship networks studied must be extensive, extending in each case along all possible direct, collateral, and consort lines, and the authenticity of the pedigree must be doubly sure. The data so collected must then be reduced, and, thanks to the recently discovered methods of analysis, such processes slowly but surely wrest from nature the truth concerning the manner of the inheritance of the traits studied. By the expression "understanding of the behavior in heredity" is meant that ability, by the study of the somatic appearance and the ancestry of two parents, to work out their germ-plasm formulae, and to predict the nature of their offspring, in reference to their traits under observation. When such predictions can be accurately made, it will be in order for the social workers to take up the thread, to promote the diffusion of knowledge concerning the inheritance of traits, and to shape public opinion as to fit and unfit matings, and to promote legislation concerning the best means of eugenic amelioration.

This new science owes much to Dr. Charles B. Davenport, Director of the Carnegie Station for Experimental Evolution at Cold Spring Harbor, Long Island, New York. Extending his studies from plants and animals to man, he has become the foremost authority on human inheritance in America. In his earlier Eugenic studies he described to a nicety the behavior in inheritance of albinism, of eye and hair color, and hair form, did much to solve the riddle of the behavior of skin color in white and negro crosses, and instituted many other lines of investigation. He has secured funds for the establishment of the Eugenics Record Office at Cold Spring Harbor, Long Island, New York. This institution, which seeks to be a clearing house in matters pertaining to human inheritance, is the first of its kind in America, if not in the world, and its activities under Dr. Davenport's direction consist in training for institutions and positions concerned with Eugenic investigation, persons expert in collecting at first hand in the home territory of the families studied, records adequate to Eugenic research; in employing on its staff a limited number of such trained workers assigned to special problems; in indexing all obtainable specific data on human inheritance; in promoting a general interest in Eugenic research; and in analyzing the assembled data with the view of determining the laws of inheritance. There has just been completed an index or catalogue of analysis of human traits, mental, physical, normal, and pathological. The scheme

of this index is quite similar to that of the Dewey decimal system for classifying books, the general headings being:

0. General Traits,
1. Integumentary System,
2. Skeletal and Muscular Systems,
3. Nervous System,
4. Mental Traits,
5. Sense Organs,
6. Nutritive System,
7. Respiratory System,
8. Circulatory and Lymphatic Systems,
9. Excretory and Reproductive Systems.

All available material is being indexed according to surname, place, and trait. At the present time the office is making a special study of insanity, epilepsy, feeble-mindedness, Huntington's chorea, hare-lip, musical talent, mathematical talent, resistance and susceptibility to tuberculosis, cancer, and skin color. Ultimately it is hoped to extend these studies over the entire range of human traits. The above studies were selected for the first investigation on account of their bearing upon the treatment of the eleemosynary classes of the country with the possible hope of ultimately cutting off the supply of defectives.

The various races of domestic plants and animals were bred to a high state of perfection through two processes, namely, (1) the cutting off of the lower levels, and (2) by mating the best germ-plasms of the upper levels. Thus a more remote development of the Eugenic program must call for a promotion of the general knowledge of the inheritance of traits to the end that public sentiment may direct the inclusion of Eugenic studies in every liberal education, that marriage laws and customs based upon scientific truths may evolve. But alluring as the prospect may seem, we should not lose sight of the fact that the present program is *research.*

NOTE.—Readers of the NATURE-STUDY REVIEW and students of nature generally doubtless find much interest in human nature and its mutation from generation to generation. Those desiring to participate in Eugenic studies can address letters to the Eugenics Record Office, Cold Spring Harbor, Long Island, New York, which office will supply forms and suggestions for recording family traits adequate to Eugenic research.

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Dental Hygiene

HYMAN COHEN, M. D.

Assistant Chief, Bureau of Medical Inspection, Department of Health, Chicago.

The teeth, though stationed at the front door of life and readily visible, have been entirely overlooked until recently. At most, they were given some aesthetic recognition by "fastidious" people. The recognition of the fact that they form a vital organ in the human mechanism, upon which depends the proper growth and development of the body, is only of recent date and limited to small circles. That the teeth are the mill stones of life, which, if properly grown and well kept, promote perfect mastication, digestion and assimilation, making the greatest contribution to the buoyancy and happiness of life, is not generally understood.

Each individual is provided with two sets of teeth during his lifetime for his use. The temporary or milk teeth, beginning to appear about the seventh month of life; having fulfilled their duty, they gradually disappear, their roots being absorbed and the crowns falling out, to the great delight of the young person. About the twelfth year all of the temporary teeth have disappeared. During their sojourn in the mouth they also aid in the symmetrical development of the jaw bones and remain on duty until the permanent teeth appear. The first permanent teeth appear about the sixth year and the set is usually complete about the thirteenth year, excepting the last molars. The milk teeth are there to prepare and hold their places for the permanent teeth until the growth of the jaw bones can accommodate the full set. It is the only instance in the human body where an organ, treating all the teeth as one organ, is entirely discarded to be replaced by a larger, stronger and more durable similar organ. This lesson must be borne in mind. Milk teeth should not be hastened out of the mouth by neglect and decay, or by unnecessary extraction. On the other hand, it may frequently become neces-

sary to remove a milk tooth when it has outlived its usefulness, either in point of time or in point of efficiency. The child has to double its weight several times. He must chew much food and convert it into living body tissues. Much food is also needed to provide animal heat and for the large expenditure of energy on the part of the healthy growing child.

In the sum total of life the aesthetic part of nature's string of pearls is of no inconsiderable importance. The sparkle of the eye and the bloom of the youthful cheek are both at at disadvantage without the solid support of a perfect set of teeth of scrupulous cleanliness.

THE TEETH AS PATHOLOGIC LEVERS.

Ninety-seven per cent of children's mouths are found diseased. The British Dental Association by examining 10, 517 children found that the teeth in 86 per cent showed definite signs of decay. There are no less than 200,000 children attending the elementary schools of London whose teeth are damaged to such an extent that urgent treatment is needed. Out of 10,000 children examined in Strassburg, only 4.3 per cent had sound teeth. Of another series of 2,269 children examined between the ages of three and four, only 362 had good teeth—less than 16 per cent. Of 2,103 between the ages of 6 and 8, only 7½ per cent had sound teeth. Of 20,000 children examined in Germany, between the ages of six and sixteen, 95 per cent had dental caries to an alarming extent. A carious tooth offers a break in the continuity of the body—an open doorway to infection. The instances of hereditary diseases, or imperfection of the teeth, are comparatively rare and would not of themselves create such a serious problem as the figures above quoted indicate. Most of the diseases of the teeth which produce so much havoc and destruction, and are the source of so much pain and suffering, are the result of our own carelessness and neglect. Uncleanliness is the root of the trouble.

The mouth is the natural home of many varieties of bacteria; there they find the proper temperature and moisture for their growth, but proper temperature and moisture in themselves are not sufficient to support the life and multiplication of these bacteria. An uncleanly mouth littered with food particles lodging between the teeth offers them the necessary food for growth and rapid multiplication. The food particles further aid the destructive action of the bacteria on the teeth by their decomposition and the formation of acids which injure the enamel or the outer

coating of the teeth, and thus create an easier route for the ingress of the bacteria into the teeth and their onslaught upon them. The accumulation of tartar, which frequently results in injury and infection of the gums, is also the direct result of uncleanliness.

In addition to the large numbers of many varieties of bacteria causing general disease of the teeth, there have been found the germs of tuberculosis, diphtheria and other specific contagious diseases. The pus producing bacteria abound in unhealthy mouths. The teeth are subjected to many physical irregularities and deformities. Bottle-fed babies, children who have suffered from rickets, hereditary blood diseases, or have their breathing passages obstructed by large tonsils or adenoids; children who have suffered from scurvy, or whose health is undermined by constitutional disturbances, show it in their poorly developed, malformed and unsymmetrical teeth, jaw bones and arches. The associated organs and functions suffer indirect injury.

THE RESULTS OF UNCORRECTED PATHOLOGIC CONDITIONS.

Through the action of the acids and bacteria the dentine becomes worn out, the pulp becomes diseased, cavities form, pus and other irritating substances begin to exude, adding fuel to the destructive fire. The tartar accumulation about the necks of the teeth force back the gums and injury and infection of the gums result, the jaw bones frequently become infected and abscesses form. The teeth are sensitive and painful, the breath is fetid, the food cannot be well chewed, the nerves howl with pain, the mouth becomes a crucible of destruction. A well man with sick teeth will soon go the way of his teeth—to decay.

The first of the general functions of the body to suffer is that of digestion. Much stress is now laid on proper and sufficient chewing of food. This stress is soon turned into distress if the teeth are in bad condition. Sound teeth bite the food and make no noise. Decayed teeth bite the nerves and shout the sufferer's woes. A mouth littered with decayed teeth is the gateway to dyspepsia and decrepitude. When the teeth are diseased and painful the food is not properly chewed and is bolted in lumps. This causes disturbances in the stomach. In addition to the food not being properly chewed it is also contaminated with large quantities of pus and a great number of bacteria, which further irritate and hinder proper action of the stomach on the food. The general nutrition of the body suffers and in

the case of the child there is a general retardation and stunting of growth and development.

Through a general lowering of vitality contagious diseases, the bane of childhood, find it easier to lay hold of their little victims. The cavity of a tooth is a veritable stronghold to the germs producing the contagious disease. There they can remain at ease waiting for a favorable moment to seize upon their victims. Thence, also, they sally forth invading the bodies of other children, making use of their hosts to carry them from one to another, thus turning them into what is known as "Carriers." These "Carriers"—children who are not themselves clinically sick but harbor the germs in their throats—are frequently the cause of epidemic outbreaks of contagious diseases.

The respiratory function suffers serious impairment if the teeth are allowed to become diseased and to fall out in early life, thus interfering with the proper development of the bony roof of the mouth which forms the floor of the nasal breathing spaces above. The nose thus becoming narrowed and obstructed, mouth breathing is resorted to and the air taken in, besides not being properly warmed and filtered by the nose is further contaminated by the foul exhalation of the diseased mouth. This in turn impoverishes the quality of blood which then offers lessened resistance to the various disease processes, and thus a vicious circle is established.

The nervous system suffers immensely through the diseased and decayed teeth. When Johnny stays home with the toothache, it is more than a proverbial joke. It is not only a painful and frequent experience for the child, but a bitter accusation against those who have the welfare of the child in their keeping. Of all the nerves of the body those supplying the teeth are the most sensitive to pain, hence nature has provided them with a solid, hard covering for their protection. When we allow uncleanliness and decay to bore a hole through nature's covering we lay the nerves bare to painful shocks and expose the child to untold suffering and most injurious nervous drain. There is a striking parallelism between the physical, mental and moral backwardness and bad oral conditions. Defective teeth keep children from school and from work; they make truants and laggards of them. The pain and irritation, the disturbed digestion, the hindered respiration, throw the entire organism out of gear, resulting in an unnatural and irritating state of body and mind—a fertile soil for backwardness, delinquency, perversion, abnormal cravings and crime.

THE AWAKENING.

When the efficiency of the individual, for economic reasons, became the concern of the State, the problem of diseased teeth became "painfully apparent." In 1885, Dr. Jensen of Strassburg, Germany, instituted a free dental dispensary for the care of the school children. Today 78 German cities have such clinics, and the original institution of Dr. Jensen is much enlarged. Every child is subjected to a dental examination on entering school and twice a year thereafter until the age of 13 years. The work was also taken up in other German cities even on a larger scale. About the same time the work was taken up in England and today there are in London 17 school dentists and in the English provinces 52. In Stockholm, Sweden, all children are being examined for dental defects. Russia, France, Switzerland and many other countries have since taken up the work. In America, Rochester was probably the first city to take up the work of saving the children's teeth. It now has three dispensaries in charge of paid dentists. Particularly good work is being done in Cleveland, where a complete inspection of all school children was made, three dispensaries established and an attempt made to scientifically show the good results attainable through early and proper care of the teeth. The results obtained were beyond the most sanguine expectations. Not only were the children spared much pain and their working integrity preserved, but the mental condition improved 99 per cent, as proven by repeated psychological tests. In New York dental clinics at several of the hospitals and dispensaries have been established under the auspices of the Children's Aid Society. The work is also making progress in Boston, Philadelphia, Washington, Baltimore, Detroit, Milwaukee and St. Louis. Everywhere the importance of the teeth to the health and happiness of the race is being recognized and the work of preservation is gradually assuming organized form, having in many instances the support of the municipality. Official recognition was given the work of dental prophylaxis when Congress unanimously passed a bill providing for the appropriation of two dental inspectors for the District of Columbia.

THE WORK OF REGENERATION.

The child should be the starting point of all the activities to prevent dental decay. Beginning with infancy, artificial feeding should not be resorted to unless absolutely unavoidable. Chil-

dren artificially fed lack in general resisting powers, suffer from nutritional disturbances and do not always get a sufficient amount of lime in their food necessary to the proper growth and quality of the teeth. Rubber nipple, pacifiers and thumb sucking should be prohibited. During teething nothing is necessary but regular feeding, plenty of water, enough sleep and plenty of fresh air. Rubbing of the child's gums or any other manipulation in the mouth will only irritate the child and is not productive of any good. The lancing of the gums to facilitate the eruption of the teeth should not be practiced. It only results in increased pain and possible infection. The lesson of cleanliness should be taught early. The proper use of the tooth brush morning and evening should form a part of the daily life of the child. The mouth should always be kept free from food particles. Children should undergo a dental examination twice a year. The milk teeth during their stay in the mouth are just as important as the permanent teeth, and they are not any more likely to deteriorate and decay if properly cared for. They should on no account be sacrificed at the least annoyance brought on by uncleanliness. The irritation should be removed and the teeth retained until the permanent teeth are ready to appear. If they are extracted before that time the space for the permanent teeth is encroached upon and when one does appear it cannot take its proper place, there is no room for it to join its fellows in regular line and is pushed aside, and so spoils the symmetry of the teeth and thus the tooth is considerably weakened and not of as much use as it should be. A part of the child's education for the preservation of the teeth is to teach it to properly chew its food and to accustom the teeth to coarser foods, which results in a better blood supply, tending to make stronger, sharper teeth which are less likely to decay. At this period all of the other physical hindrances, such as enlarged tonsils, adenoids, nasal obstructions, hair-lip, etc., should be eliminated so as to insure the proper growth of the teeth. If children fear the doctor the dentist is doubly dreaded. Wise parents will implant no such fear in their children's minds. Frequent visits to the dentist for the purpose of inspecting and cleaning the teeth, and to fill in a cavity that may have formed should be made. If a milk tooth is decayed beyond repair and becomes a menace to the health of the child, or persists beyond its natural time, interfering with the appearance of the permanent tooth, it should be extracted. A very important thing to remember in this connection is that the first permanent molar, or grinder, the sixth tooth from the center

on either side, appears about the sixth year. This tooth is often mistakenly pulled out under the impression that it is a milk tooth. If this is done the child has to get along without this important tooth for the rest of its lifetime. Extraction of this tooth also results in faulty development of the jaw.

If the child is the starting point in this work of regeneration, the school is the central point. Considering the fact that only ten per cent of the population of the United States are in the habit of visiting the dentist, it is not safe to rely upon the initiative of the parents to look after the welfare of the children's teeth. The school offers a peculiarly favorable vantage point both for the correction of the immediate faulty dental conditions found in the children as well as for carrying on the propaganda in favor of dental hygiene, and laying a solid foundation for widespread future dental prophylaxis. Here we have the next generation in the formative stage—the disease tendencies perhaps not yet widespread and strongly rooted. Where such tendencies exist they can be eliminated by early and prompt attention. Here also the child feels freer from the narrow and cramping forces and superstitions of many homes. Under the influence of teacher and principal, in the presence of its fellows, it grows more self-reliant, more sensitive to its bodily imperfections and trustingly follows the guiding hand that would stop a pain, preserve a tooth and give it added vigor of body and mind. Here above any other place the lesson of cleanliness can be thoroughly grounded into the consciousness and practice of the child. In Cambridge, Scotland, they have organized tooth brush clubs and tooth brush drills. Economic considerations also point to the school as the most favorable center for the activities in behalf of the preservation of the teeth. The children are aggregated in large numbers and the work can be done cheaply, without delay and without loss of time. The work at the school should include periodic inspection of the children's teeth and daily tooth brush drills. Each school should also have a properly fitten out dental clinic where temporary and permanent fillings and necessary extraction can be done.

The real battle-ground, however, is the home. Unless the co-operation of the home is secured the good start made at the school will not prove availing. The hearty support of the parents is needed in order to make the children do at home what they were taught to do at school. The consent of the parents is also needed before any necessary operative procedures can be employed. Here, as in all large health problems, the basis is

popular education by every means possible—through the press, through the pulpit, emanating from the school and through personal effort. With this end in view, the various boards of health issue circulars of information pertaining to the teeth, to the parents, using the children as disseminators of information on the subject.

LEAFLET ON THE CARE OF THE TEETH SUPPLIED TO THE CHILDREN, NEW BEDFORD, MASS.

What are the teeth for?

Not merely for ornament. Their chief use is to prepare the food for the stomach—to grind the food and mix it with saliva. Food which is not thoroughly chewed causes indigestion and constipation.

How long should the teeth last?

To the end of life.

How do we lose them?

By decay and loosening.

What causes teeth to decay?

Bits of food and candy sticking to the teeth; also a poor physical condition.

Where does the food lodge?

All along the edge of the gums, between the teeth, and in the crevices of the grinding surfaces.

Can decay be prevented?

Yes, to a large extent.

How can decay be prevented?

By scrubbing the teeth thoroughly with a tooth brush, tooth-powder and water; and by keeping up the general health.

How often should the teeth be cleaned?

At least twice a day—after breakfast and at bed time. Better after each meal.

How often should tooth-powder be used?

At least once a day—at bed time.

Twice a year at least a dentist should carefully examine the teeth.

A bad condition of the throat, the nose, and the ears is made worse by decayed teeth. They add to the chances of catching infectious diseases. Well cared for teeth and a clean mouth help prevent TUBERCULOSIS.

Cleanliness is the best guard against disease.

ECONOMICS OF THE TOOTH PROBLEM.

Dr. Gulick makes the statement that two bad teeth in a

child's mouth will retard that child in its school studies for six months. The per capita cost of educating a child in the elementary schools varies from $20.00 to $35.00 a year. Even not counting the ultimate loss caused by bad teeth, through lack of vitality and working efficiency of the individual, one can readily see what an enormous loss is sustained by the community through faulty and uncorrected dental conditions. Many children fail to make their grades on account of their bad teeth, and the community has to cover the cost of re-educating them. The cost of correcting faulty conditions and of maintaining a mouth in good shape, and preventing decay of the teeth is in England $1.00 per child treated; in Germany about $0.82; Rochester, N. Y., $0.57 and in Chicago about $0.50. One can readily see what an enormous financial, material and moral gain to the community would result from the expenditure of a relatively small initial sum by the municipality to institute and further this work, and yet there are short-sighted tax payers, lethargic legislators, and not a few old-time educators who fail to see the crying need that exists for and the great improvement that would result from a municipally backed movement to improve the teeth, the health and the moral caliber of its citizens.

THE WORK IN CHICAGO.

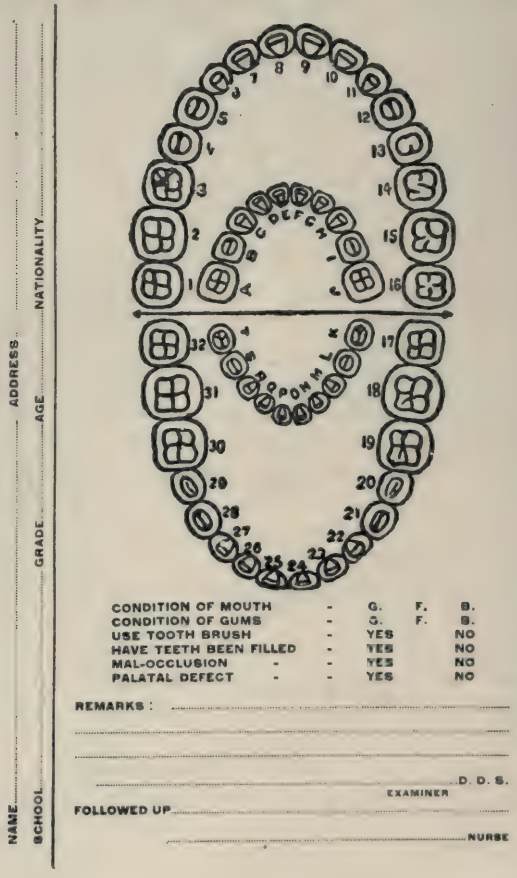
There are about 260,000 children attending the elementary classes of the 260 public schools of Chicago, and about 80,000 more in attendance at the parochial schools. The conditions obtaining in Chicago with respect to dental defects in children were found to be essentially the same as in other cities.

Soon after the physical examination of children was begun in 1908, it was found that faulty conditions of the teeth far outranked all the other conditions in frequency, constituting no less than 55 per cent of all defects found. Of 120,301 children examined in 1910, the medical inspectors found 43,922 children suffering from faulty oral conditions. Had these examinations been made by dentists equipped for the work the percentage of diseased teeth would undoubtedly have been found just as high as elsewhere—about 97 per cent. Towards the end of 1910 the work was taken up by a volunteer corps of dentists. Of the 9,000 children examined by them in 53 schools 96.8 per cent were found to be in need of dental attention.

Beginning with 1911 an appropriation was secured for a supervising dentist and the work taken up in earnest with the co-operation of the school authorities.

We now have an organized voluntary force of 59 dentists putting in a half day a week each in 59 schools. One dental dispensary, under the supervision of the Health Department, is now in operation and two more are to be opened in January, 1912. The staff at each dispensary consists of six dentists and one extractor, who holds a clinic once a month, also a bacteriologist for special research work.

All examinations are conducted with the strictest aseptic precautions and the findings are noted on a special blank form in triplicate. One copy is held at the school with the other records of the child, one is filed with the Health Department, and the third is sent to the parents of the child. This last conveys to the parents general information relative to the importance and care



of the teeth and also acquaints them with the actual conditions found in the child needing correction. If conditions exist requiring immediate attention they are directed to take the child to a dentist. If unable to do so they are to fill out an application requesting that the child be given free dental treatment at the school clinic.

The blank has a diagram showing both the temporary and permanent sets of teeth. The system of notation is uniform. A cavity in any tooth is indicated by a solid circle on the diagram of that tooth, placed on the side on which it is located. A tooth which needs to be extracted is marked by "X." If a tooth is completely broken down, the entire surface of the diagram of that tooth is covered with a solid circle. Where the roots require treatment it is indicated by double lines, beginning at the tooth and meeting at some distance from it, which resemble the shape of the roots. The other information pertaining to the child and to the various conditions found and the extent of the same are entered under appropriate headings.

So far only a beginning has been made. The work needs to be pushed. The public needs to be awakened, educated to the importance of the problem and its self interest aroused. Fifty paid dental inspectors, each in charge of five schools and working a half day in each of his schools every week, would satisfactorily meet the needs of the situation. In addition there ought to be established ten fully equipped dental clinics centrally located, and in charge of a paid dentist, for each group of 25 schools. This is not an expensive program and would prove one of the best community investments when viewed with an eye toward the future health and efficiency of its growing citizens.

Editorial

However many things nature-study may mean to various persons the apparent differences are but changeful expressions of a fundamental unity. While it is a study of nature it is limited by definite aims and principles. It is at once a method of approach, a content of information and a spirit of appreciation.

The method is the method of science—the derivation of correct conclusions from first hand observations made independently by each pupil. To habituate the child to such a method of procedure is to set him on his feet intellectually. All paths are open to him and he treads intricate ways with confidence. Citizens so trained are the safeguards of democracy.

The content of information varies with the community. Every child before he leaves school needs an acquaintance with the great and fundamental laws of nature which condition his own health, his community functions as wage earner, parent and citizen. The majority of pupils must acquire these fundaments in the grades.

The spirit of nature-study is the spirit of practical every day affairs, the spirit of commercialism, if you please, and the cold impartial spirit of science—these, plus the glow of the artist, the charm of the raconteur, the fervour of the poet, the faith of the seer.

Such a statement approximately expresses the consensus of opinion among the leaders of nature-study. The significance of the term is sufficiently clear so that it no longer provokes conspicuous discussion. Agreeing now substantially on the aims, materials and methods, the problem is how may the materials be arranged, how may the methods be applied to insure the accomplishment of the desired ends and the generation of the proper spirit. The problem of the nature-study teacher is no longer merely a qualitative problem but a quantitative one. We must devise indicators of our progress, measures of our success and accurately test our methods.

When do the nature interests of the child arise? What are they? How do they change from year to year? How may they be stimulated? What nature-study materials and methods are most effective in sharpening the senses? Can we measure the progress of pupils in the attainment of the scientific method of approach? If so, how? May we measure the efficiency of various

types of nature-study instruction in the schools in the actual improvements of neighborhood sanitation, in the reduction of juvenile crime, the comprehension of English literature, the appreciation of poetic sentiment, the increased facility of artistic expression. We must have not alone the opinions of enthusiasts whose judgments will be more or less discounted, but quantitative studies, data capable of mathematically exact expression, that will appeal to the cool judgment of the educational administrator. Here is work for a generation of nature-study pedagogues. It is the next step forward.

News and Notes

School Gardens in California.

Mr. Elliot R. Downing,
Chicago, Ill.

My Dear Mr. Downing:

As Secretary of the American Nature-Study Society, I am sending you a brief report of the Stockton meeting. Agricultural education is gaining considerable momentum in this state. We are now in touch with seventy-five definite organizations. The basis of our nature-study and agricultural work in California is the school garden. We now have about four thousand boys and girls making up one large California Junior Gardening class. Of course there are thousands of others who are gardening in California but who are not in direct touch with the University.

Yours sincerely,

C. A. Stebbins.

Berkeley, Cal.

Convention at Stockton, Cal.

The California Section of the American Nature-Study Society met in joint session with the Bay section of the California Teachers' Convention, Stockton, December 28 and 29.

President Babcock called the meeting to order on December 28. The following program was given:

Stereopticon Lecture on School and Home Gardens.—C. H. McCollum, Supt. Cleveland Home Gardening Association.

What the Farmers Want the Schools to Teach in Vocational Subjects.—H. W. Wrightson, representing the California Division of the Farmers' Educational and Coöperative Union of America.

How the College of Agriculture of the University of California is Trying to Coöperate With the Schools.—W. G. Hummel, representing the College of Agriculture, University of California.

What the State Should Do for Agricultural Education.—Frank V. Cornish, representing the Commonwealth Club of California.

Mr. F. V. Cornish and Mr. H. W. Wrightson gave the business man's and the farmer's point of view. Both urged the teaching of nature-study and agriculture.

Mr. C. A. Stebbins, of Berkeley, was elected president, and Miss A. Sellander, of Oakland, Secretary-Treasurer, for the coming year.

Nature Study in England.

In England, the School Nature-Study Union, organized in 1903, is the society corresponding to the American Nature-Study Society, and its official journal, *School Nature Study,* fills the place of the Nature-Study Review in relation to our own society. It is published five times annually, at least 1800 copies per issue, and is edited ably by Miss C. von Wyss of the London Day Training College. The honorary secretary of the Union is Mr. Henry E. Turner, Principal of the Open Air School near Woolwich.

The present outlook for nature-study in England is thus stated in *School Nature Study,* February, 1911, by the editor:

"Never has the Nature Study movement in England been more vigorous than at the present time. The work at the higher centres of education of preparing and training students in Nature Study has produced a generation of teachers who have some grasp, both of outlook and method, characteristic of the subject, as well as a small store of knowledge acquired in the right way. Teachers more experienced in other respects, but unacquainted with nature lore in any form, have had their attention drawn to the educational value of such work, and have availed themselves of the innumerable courses of instruction that have been provided for them, and of the teaching of many books recently published, in qualifying themselves for the new task.

"The most enthusiastic supporters of the cause are not blind to the fact that there are still many shadowy corners where enlightenment and sound educational principle have not reached, and where the words Nature Study, a name of good repute, is a cloak covering proceedings that have little direct relation to either nature or study as far as the children are concerned. May there soon be light!

Book Reviews

Sweet Peas, by Horace J. Wright. Frederick A. Stokes Co., New York. 116 pp. $0.70.

This is one of a series of hand books on garden flowers in color, a series that delights the heart of the amateur enthusiast as well as the specialist, for each flower is written up by an ardent admirer and successful grower. Each book is therefore eminently practical, and is illustrated with some exquisite colored plates. Among the chapters are those on "The History of the Sweet Pea," "Making New Varieties," "General Culture," "Enemies and Diseases," and a bibliography.

Agriculture Through the Laboratory and School Garden, by C. R. Jackson and Mrs. L. S. Daugherty. Orange Judd Co., New York. X—450 pp. $1.50.

The new text books that are appearing in agriculture begin to assume a distinctive character. The early school-texts on the subject seemed merely a selection of chapters from school botanies and school zoölogies, with a smattering of information on farm and garden. Actual agricultural material makes up the bulk of this volume, and it seems well organized. About a hundred pages are devoted to soils, some fifty pages to plant nutrition, nearly one hundred fifty pages to practical handling of plants, propagation, pruning, etc. Farm animals receive treatment in some forty pages. The book seems well written, is well illustrated, and should prove a valuable addition to the available texts in agriculture. As would be expected from the title, there are many practical exercises in the book, and the directions are sufficiently explicit so that children can follow them.

Principles of Vegetable Gardening, by L. H. Bailey. The Macmillan Co., New York. X 458 pp. $1.50.

This is the latest volume in the Rural Science Series edited by Professor Bailey. The excellent character of the preceding volumes in this series, together with the fact that this appears with Professor Bailey's name as author, assures a valuable book from the outset. It is primarily a book for the commercial gardener, but it will prove of large value to the teacher of gardening, for one may be sure that the directions and data furnished the practical man are entirely reliable.

Part one gives a general view of the subject; part two takes up the various garden crops. Successive chapters in the first part are on the planning and equipment of the garden, gardening under glass, the soil and its treatment, tools, seeds and seedage, subsequent management, marketing and storing. Each topic is discussed with a breadth of view and in an enlightening manner with conditions in mind the country over. One finds maps of the chief trucking centers of the states, data regarding cost of equipment east, west and south. Part two opens with a selected list of books and bulletins on gardening and crops; other literature is also cited in the chapters that follow. These chapters on garden crops and their culture are evidently digests of recent reliable publications culled from a wide range of reading and subjected to further selection by tests of successful experience. On the whole the book can scarcely be too warmly recommended.

Gardens and Their Meaning, by Dora Williams. Ginn and Co., Boston. 235 pp. $1.00.

This book is not so much a garden manual as it is a manual of the art of education through the garden. The school garden is the garden under discussion and the author purposes to elucidate the aims, organization, methods and achievements of the garden as an ally of education. In the chapter on "Just How" explicit directions are given for planting and cultivating the common vegetables that children grow, and a table in the appendix gives briefly similar information for twenty flowers. As a rule, however, the volume is concerned more with the administration of the garden than with the methods of operation. Thus under bulbs "Explicit directions for the special treatment each requires will be found in the catalogues." Particularly good chapters are those on What Makes a School Garden Worth While, Situation and Soil, Side Shows, New Life and Old Subjects.

"The examination of evidence from many sources leads to the conviction that by allying a garden with the time-honored subjects in schools, academic work may be greatly enriched. Instead of robbing these subjects of so many golden minutes, the garden may kindle afresh an unquenchable desire for their pursuit. * * * Let real things, then, in greatest abundance go on in the garden. Guide young people; do not thwart them. And in the meanwhile, not in order to make gardens but to help mature joyous souls, let the course of study become so plastic

that all sorts of activities may be worked into the beautiful substance which is life."

Beginnings in Agriculture, Albert R. Mann. The Macmillan Co. pp XII and 341. $0.75.

In his preface the author states that "This book is designed for the purpose of introducing the study of agriculture into the seventh and eighth grades of our elementary schools. * * * It has been the aim of the author to cover the work very largely in a nature study spirit." A school garden is a desired accessory. Field topics are strongly urged.

The opening chapter is on "the community in which I live." This is commendable. Nature-study properly stays at home. Chapter two is on home geography. These chapters are brief but suggestive. Part I aims at a survey of the whole field of agriculture and is simple, readable and practical because of the problems under each topic. These problems are a feature of the book, running all through it. Part II is on the soil, 50 pages; part III, farm plants, 128 pages; part IV, farm animals, 95 pages. The book is intended to be used as a text for two years work and so used it should be an exceedingly serviceable text book. It is clearly written in language the school boy will readily comprehend, is attractively illustrated and is accurate in its statements of fact. The book would be improved from a pedagogical standpoint, at least in the eyes of a nature-study enthusiast, if the problems given at the end of the chapters came at the beginning, so as to make emphatic to the average teacher that the child should be drilled in drawing his own conclusions from his own observations.

The Social Direction of Human Evolution: An Outline of the Science of Eugenics, by Wm. E. Kellicott, D. Appleton & Co. 249 pp. $1.50.

We have learned much of heredity and its laws in the last few years, and are constantly adding to our fund of information. What has been discovered is in use by the practical breeder of plants and animals. Each new addition to the stock of knowledge in this field is appropriated with avidity. Here is a clear statement of the laws of heredity as we now know them and their application to the problem of improving the human race. The book is an elaboration of three lectures delivered at Oberlin

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OFFICIAL ORGAN OF

AMERICAN NATURE-STUDY SOCIETY

Vol. 8, No. 4
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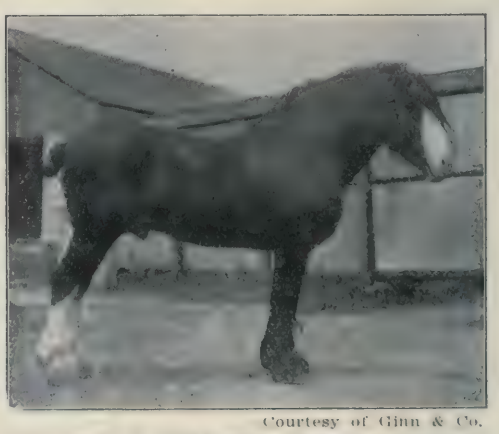

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From Chas. D. Hall's article, Some Farm Animals. November Number, 1911.

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VOL. 8 APRIL, 1912 NO. 4

Nature Study as a Servant

ANNA BOTSFORD COMSTOCK

All those present at the meeting of the session of the American Nature-Study Society, held in Washington last December, were much interested in the various ways suggested by which nature-study could be of service to other forms of education and to civic improvement. Nature-study is so wide in its application that it bears upon almost all enterprises that have to do with the physical world. There is much of nature-study that has to do with the garden, although it would seem that many of the people who conduct children's gardens are scarcely aware of it. However, it is there; and perhaps the children may find it without help. There is also much of nature-study necessary in learning to cope with those pests, like mosquitoes and flies, which threaten our health as well as happiness. But such nature-study is purely for the purpose of reconnaissance for battle and is, when considered as nature-study, very narrow and limited. There is also nature-study connected with the understanding of the principles of hygiene; but a few lessons in elementary physics would cover what is needed for this. It is right and just that nature-study should do this work in assisting these various educational and public enterprises; but, as nature-study teachers, we should never forget that such service represents only an infinitesimal part of what really belongs to the realm of nature-study; and we certainly do a great wrong to the child when we convey to him the idea that this is the chief work of nature-study.

One child said to me, "Oh, yes, I have had nature-study; we studied mosquitoes last year." And another said, "Oh, yes, I know about nature-study, we sprouted beans in our school last spring." It was evident that both of these youngsters thought

they had finished the subject. It would have been much better if one of them said "I have been studying civic improvement," and for the other to have declared "I have been studying hygiene" rather than that either should think that he had completed nature-study.

If nature-study is to do its work for the coming generation and bring about that perfect sympathy with the whole great out-of-doors and establish spiritual as well as bodily sanity, it must stand for all of nature and not for detached bits of it which may be utilized in this or that other study or enterprise. The child forgets himself when he is doing the best nature-study, which should give him sympathy and understanding with all birds and not merely with the ones which work for him; and for all trees whether they make good timber or not; and for all insects whether they help or hinder him or remain neutral; and for the skies and the eternal stars as well as for the soil beneath his feet.

It is only in the larger sense and in the widest bounds that the companionship with nature may be established, and this ideal is, after all, what makes nature-study worth while.

The Study of Birds With a Camera

ROBERT W. HEGNER.

University of Michigan.

1. INTRODUCTION.

The object of this paper is to point out some of the methods employed by a bird photographer, and to prove that no elaborate apparatus nor exceptional skill are necessary to obtain first class results. The writer began to study birds when he was a very small boy, and, as in so many cases where small boys are not properly instructed, he began by making a collection of birds' eggs. The transition from the questionable practice of stealing birds' eggs to the laudable enterprise of recording, by means of photographs, events in the life histories of birds brought about an entirely new outlook upon birds and upon living things in general. I know of no pursuit which will teach one to love and admire all bird life that can compare with that of trying to photograph these shy, active creatures. Anyone who has placed a camera near a bird's nest and has waited hour after hour for the parents to return in order to take a snapshot, cannot help but learn something of the habits of the birds, since nothing can

whet the observational powers to so keen an edge as the long continued watching of one particular live animal in its natural environment. The study of a bird's remains in the laboratory is mere drudging compared with the far more pleasant and instructive observation of it in the field.

The writer began his photographic career with a five dollar Hawkeye camera, and spent part of the summer of 1897 experimenting with this modest instrument. The results may be judged by one of the photographs which appeared in the first volume of Bird Lore[1] and was called by Mr. Chapman a "unique picture of a Bluebird." This camera, however, was clumsy and was exchanged the following year for a long-focus Premo—a fairly good instrument at that time. Sine then great improvements have been made, and photographs are now possible that could not have been procured with the older instruments. Reference is made especially to the combination of the focal plane shutter with the reflex principle, and the use of more rapid lenses, more rapid plates, and smaller cases. The reader is referred to special books[2] on bird photography for detailed descriptions of photographic apparatus, since we are concerned here only with a few methods (which are mere suggestions) of taking photographs of birds, nests, and eggs with an inexpensive camera.

2. PHOTOGRAPHING BIRDS' NESTS.

It is easier to photograph a bird's nest than it is to obtain a picture of the bird itself, and a nest that is built on the ground is not so difficult as one placed in a tree. For example, one of the earliest of the nest builders in the Middle West is the Prairie Horned Lark. Often the nest of this bird is completed before the snow has left the ground and frequently snow storms occur after the eggs are all laid. The nest is a slight hollow in the ground, lined with dry grasses. Three or four eggs are usually laid. To take a photograph of such a nest all that is necessary is to set up the camera three feet from it and pointing down at an angle of 45 degrees; then, if the sun is shining too brightly, decrease the intensity of the light that falls upon the nest by interposing a piece of thin cheese cloth. A short exposure with a small diaphragm will give more detail than a snapshot with the lens wide open. *Figure 1* shows the nest of a Prairie Horned Lark which was photographed rather late in the season. It was

[1]Bird Lore, Vol. I, pp. 43-44.

[2]For example Mr. Chapman's "Bird Studies with a Camera," and Mr. F. H. Herrick's "Home Life of Wild Birds."

evidently a second effort of a pair of birds to raise a family, the first nest having probably been destroyed by a cold wave or by a farmer's plow. In this nest are two eggs of the Cowbird besides those of the Larks; the former may be distinguished by their larger spots.

A considerable ability to climb trees is of course necessary in order to photograph nests that are built in trees, and the operator must not be afraid to stand upon small branches and hold on to other small branches with one hand while the camera is being fastened for a snapshot. One of the difficulties encountered while photographing nests in trees is that of getting the camera the proper distance above and to one side of the nest. This may be accomplished by strapping the camera to the limbs, but a better method is that of fastening the camera to a branch with a holder such as is used by bicyclists to attach the instrument to the handlebars. Another difficulty is that of getting an even light, since leaves and branches overhead almost always cast shadows upon the nest. There are two methods of solving this problem; one is to move the interposed branches to the side—a process that is not often possible; the other is to cut off the limb bearing the nest and move it out into the open. The latter method is feasible in some cases, as will be shown later, but should not be employed if possible on account of the danger of driving the parents away from their home.

3. PHOTOGRAPHING ADULT WILD BIRDS.

The goal of every bird photographer's ambition is to ob-

tain a view of the adult wild birds at their nest. Fortunately birds are very solicitous of their eggs and young and will often place themselves in danger in order to be near them. Among the first things the observer learns is that some species of birds are less afraid of a camera than others, and that individuals belonging to a single species differ widely in this respect. The nest and eggs or young should be used as the attraction by means of which the parents can be drawn within the range of the camera, and a comparatively fearless bird, such as a House Wren or a Bluebird, should be selected for the first experiments.

Given a camera placed three to five feet away from a bird's nest and focused upon it, the problem is to take a snapshot from a distance so that the operator will not frighten the parents so much as to prevent their return. This difficulty may be met in a number of ways the easiest of which is to attach a string to the shutter-release so that a pull will take a snapshot; then lie in wait at the end of the string at a distance of several hundred feet until the birds become so anxious about the safety of their eggs and young that they will brave the dangers of the camera's presence and pay the nest a visit. The length of time necessary to wait may be only half an hour, or several days. Another method is to connect the shutter with a very long rubber tube through which air may be forced by a large rubber bulb, or better, by a bicycle pump.

Figure 2 shows a Killdeer standing over her nest and four eggs. The eggs of the Killdeer are very difficult to find because they resemble very closely their surroundings. The nest is merely a slight hollow in the ground, usually near a stream, and often in a corn-field. An intruder is noticed from afar, and the sitting bird silently slips off the nest and sneaks away to a safe distance. Then she begins her piercing, pathetic cries in order to attract attention away from her nest. If one seeks a hiding place near by and patiently watches her, he will see her slowly circle about, getting closer and closer to the nest until she reaches it; then she sits down upon it after a last look around to see that the coast is clear. The bird shown in Figure 2 was not very much afraid of the camera so near her nest, but returned about

an hour and a half after everything was arranged for taking the snapshot.

Young Killdeers are able to run about soon after hatching so when the time approached for the eggs to hatch a low wall of flat stones was built around this nest so that the young could not get away after they emerged from the egg shells. The day after they hatched they were found hiding in the crevices between the stones. As is the case with the eggs, the young are so nearly like their surroundings in color that they can easily be overlooked and thus must frequently escape the eyes of their natural enemies.

The Bluebird whose picture is shown in *Figure 3* was a very

devoted father. His nest was made of dry grasses in a cavity in a fence post about three feet from the ground. The five young were taken out of the nest cavity; a stick was then wedged into it horizontally, and the baby Bluebirds were posed upon it in a row. The camera was then placed about three feet away. The parents flew about excitedly for about half an hour before they gained courage enough to approach their home. Finally their solicitude for their young overcame their fear of the camera and the father bird, who proved to be the braver of the two, came to pay a visit to his offspring. Finding them all safe and sound, he was reassured, and started out at once on a foraging expedition. In the meantime the young became restless and four of the five fluttered to the ground, leaving a single, lone baby Bluebird upon the stick. As the figure shows, this youngster had either fallen asleep or lost his appetite, since he doesn't seem to care as much for the fine big grasshopper as a real active young Bluebird should.

Not all adult birds are as easily photographed as the Killdeer and Bluebird just described, and even these results were obtained only after considerable effort. The nest must be found first, and this, at least in the case of the Killdeer, is no small undertaking. Then the apparatus must be arranged for the picture and finally an abundant supply of patience is necessary while waiting for the parents to return to their nest. Besides all this, the shutter doesn't always work properly when desired and the bird may move rapidly at the exact moment when the snap is made, leaving only a blurred image on the plate. Each subject has difficulties of its own to be overcome, and this fact taxes the ingenuity of the photographer and adds incentive to the undertaking. How certain difficulties were overcome will be explained in the next installment of this paper.

(TO BE CONTINUED IN THE MAY NUMBER.)

The Meadow Lark

Sweet is his call at morn,
When in the eastern sky
Fair golden day is born.
Then from the fields his cry
Welcomes the dawning day;
Speeds it upon its way;

Clear is his evening call,
When from the darkling west
Night's silent shadows fall,
Folding a world at rest;
Then in his homeward flight
He bids the world good-night!

Franklin, Indiana. GEORGE B. STAFF.

Agriculture In Minnesota Schools

GILBERT H. TRAFTON.

In 1909 the legislature of Minnesota passed the Putnam Act, authorizing financial aid to schools teaching industrial subjects. The sum of $2,500 was to be given annually to ten schools, either high, graded, or consolidated, which met the following conditions: (1) Departments of agriculture, manual training and home economics—must be maintained; (2) the instructor in agriculture must have had special training in the subject equal to graduation from an agricultural college; (3) a plot of ground of at least five acres must be furnished to be used for experimental purposes; (4) the course of study must be approved by the State High School Board.

These schools were so successful that in 1911 the legislature reënacted the bill and provided aid for twenty additional schools making thirty in all.

In order to provide for those schools which could not meet the requirements of the Putnam Act, the legislature passed the Lee-Benson Act, appropriating the sum of $1,500 annually to any high or graded school meeting the following requirements: (1) the school must maintain a department of agriculture and either a department of manual training or one of home economics; (2) the course must be subject to the approval of the State High School Board; (3) the instructor in agriculture must have such training as the State High School Board shall require. The Board subsequently decided that the instructor must be a graduate of an agricultural college, or must have had an equivalent training.

Under this act, state aid was extended to fifty-eight schools the first year, which together with the thirty Putnam schools and the three state agricultural high schools make ninety-one schools receiving state aid for instruction in agriculture. This is a larger number of schools receiving such aid than was reported for the whole United States in 1910 in a bulletin issued by the U. S. Department of Agriculture.

For a number of years Minnesota has had a law permitting High Schools to institute Teacher's Training Departments, whose purpose is to prepare teachers for the rural schools. There are now eighty-four schools having such departments.

This work in agriculture in High Schools is reacting on agricultural instruction in elementary schools in two ways: first

through a combination of the teacher's training and agricultural departments and second through the agricultural departments alone. Fifty-five per cent of those High Schools which have a Teacher's Training Department have also a department of agriculture, and in some of these schools the pupils who are taking the training course are also taking courses in agriculture.

Eleven of the schools receiving aid for agricultural instruction are graded schools and here agriculture is taught in the seventh and eighth grades by the regular instructor. And in some of the other High Schools the instructor gives aid in the graded schools.

The greatest stimulus to agricultural instruction in elementary schools will doubtless come from the Holenberg Act passed by the last legislature, providing financial aid to encourage the consolidation of schools. In order to receive this aid a school must be provided with a principal who is able to teach agriculture, and must furnish not less than two acres to be used for a demonstration plot. About thirty schools have taken advantage of this opportunity.

The Insect Life of Pond and Stream

PAUL S. WELCH.

University of Illinois.

PART I.

Ponds and streams of the usual kinds contain a wealth of life which is often little suspected, and they are full of surprises and interests for the youth who has a liking for the things of nature. He is, no doubt, more or less familiar with a few of the common-place insects of the fields, lawns, and gardens, but when he examines carefully the neighboring brook or pond he will find a little world which will give him new ideas of insect life. Here is a bit of the great insect world, distinct from that of field and woodland, hemmed in by the banks and shores, and made up of numbers of different kinds of insects in different stages of development. It offers splendid chances for study since water insects are easy to find, easy to collect, easy to keep alive and easy to observe either in the pools and streams or in the aquarium.

WHERE AND WHEN TO COLLECT.

The young collector needs only to go to any pond, lagoon, beach pool, swamp, marsh, brook or creek to find a suitable place

to begin collecting. Collecting will usually be better if there is an abundance of water plants growing in the edge of the water. If these places exist under natural conditions he will find aquatic insects in all situations from stagnant pools to rapidly running streams.

The collecting of water insects can begin as early as the first warm springs days and can continue all through the Spring, Summer, and even late into November. Water insects appear with surprising quickness when the ice disappears from the water and collecting continues good from that time on. Herein is another advantage for the study of aquatic insects since it can be followed at almost any time during nine months of the year.

FIELD STUDIES.

It cannot be too strongly impressed on the mind of the pupil that much valuable and interesting information can be gained by the careful and patient observation of water insects in their native haunts. Sit quietly on the bank of some stream and note what happens in this insect community. A pair of field or opera glasses are useful in watching the behavior of the surface forms. Note as fully as possible all of the conditions which make up this native haunt and record in a note book. This record can take some such form as the following:

1. Name of insect (if not known, use some temporary name).
2. Place in the native haunt (surface, under surface, bottom, etc.).
3. Date.
4. Weather (clear, cloudy, temperature, etc.).
5. Water (clear, muddy, stagnant, running, etc.).
6. Abundance.
7. Methods of locomotion.
8. Feeding habits.
9. Enemies.
10. Other observations.

The records of these observations will aid in rearing these insects, since it is necessary to reproduce in the aquarium, as nearly as possible, the conditions of the native haunt.

GENERAL METHODS OF COLLECTION.

The habits and haunts of aquatic insects are often so different that it is necessary that the use of the collecting apparatus be suited to each species and this means that there must be spe-

cial methods for each. These special methods will be given in connection with each species in the discussion which is to follow. However, a few general instructions will be given which will apply to all aquatic insects and which will enable the beginner to start his collection.

Necessary Collecting Apparatus.

The following articles will be needed:

1. A suitable water net.
2. Cyanide bottles.
3. Tight tin boxes for living specimens.
4. Quart jars, with tops, for living specimens.
5. A common garden rake.
6. Rubber boots (useful but not absolutely necessary).

1. *The Net.*

Any water net will do if it be strong and durable. The writer has found the following described dip net to be very useful in general aquatic collecting: The net is of about equal width and depth, made of fine material of about one millimeter mesh like fine bobinet and attached to the ring by means of strong muslin. The ring is made of a one-fourth inch iron rod bent in the form of a semicircle and firmly fastened to a long handle, the straight side of the ring being opposite the point of attachment.

2. *The Cyanide Bottle.*

This killing bottle is made as follows: Put a few small pieces of cyanide of potassium (buy at a drug store or from a drug company) in the bottom of any wide mouthed bottle; cover with a layer of sawdust; then fit a piece of perforated card board on the top. Moisten slightly and keep corked. *Be careful in handling cyanide of potassium; it is a deadly poison.*

How to Use the Net.

1. Put the net down into the water; move it along with the mouth open in the direction of the motion. This process is called "sweeping." Make some of the sweepings on the surface, some under the surface, some among the submerged or partly submerged water plants, some on the bottom, and some into the bottom so as to get the insects which are to be found in these different places.

2. When bringing up a net load of debris from a sweeping of the bottom, wash out as much of the dirt and trash as possible by scooping up the clear water with the net and letting it drain through. This makes it easier to examine the catch especially

since some of the dark colored forms are difficult to see in the muddy contents of the net.

3. Rinse out the net thoroughly before leaving the collecting place and on reaching home put it in a place where it will soon dry.

4. When collecting in a stream where there is a current, work up stream so that the clouded water will not interfere with the collecting.

How to Use the Garden Rake.

1. Use the garden rake in ponds and streams where there is much loose material on the bottom.

2. Rake a mass of this material ashore and examine. The insects will show themselves in trying to get back to the water.

GENERAL METHODS OF REARING.

The one important thing to remember is that natural conditions must be imitated as nearly as possible.

1. *How to Make an Aquarium (For Insects of Quiet Water).*

a. Vessels. Almost any glass vessel will do. Tumblers, jelly glasses, candy jars, battery jars, and fruit jars are useful. Be sure that they are clean before using them.

b. Put a layer of sand (about one inch thick) in the bottom of the vessel.

c. Fill the vessel with pond or stream water to within about three inches of the top.

d. Put some of the water plants found growing in the native haunts of the insects into the vessel. These will keep the water supplied with oxygen and will furnish food for some of the insects.

e. Put into the vessel a few stems which extend up out of the water. These are to serve as supports for the larvae to crawl out upon.

f. Cover with fine wire netting, or with a piece of mosquito netting or "Swiss" held in place by a rubber band.

g. Place in a north window if possible. Avoid placing in direct sunlight.

2. *How to Care for the Aquarium.*

a. Put only a few insects into each jar. Let these be of the same kind and of about the same size.

b. Avoid overheating the water. Keep rather cool.

c. Replace the evaporated water with pond or stream water.

Do not use hard water. Change the water if a foul odor or a film appears in the jar.

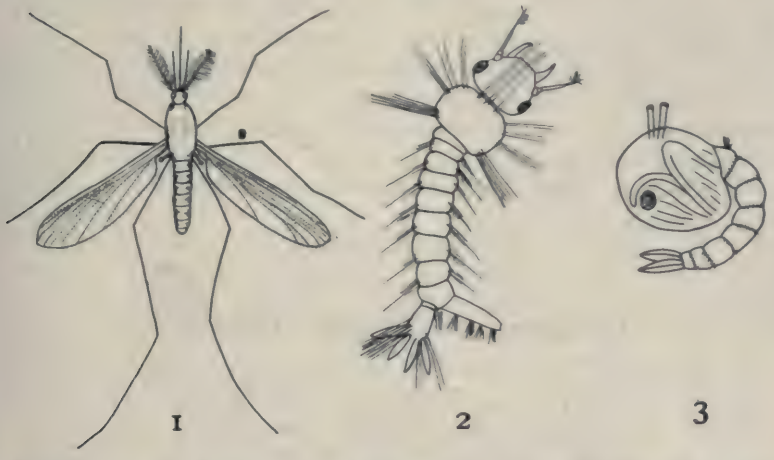
d. Supply suitable food for the insects.

3. *How to Make the Outdoor Aquarium (For Insects Living in Running Water).*

A very simple out-door cage can be made as follows: Take a banana crate or something of similar shape and size; remove all of the extra wooden parts leaving only the bare frame; saw this frame across in about the middle of its length; surround the side and one end with fine wire screening. It will be better if the wire screening of the one end can be put on in the form of a lid which can be taken off at will. This cage, when finished, can be placed over any object in the natural running stream and pushed deep enough into the bottom so that the larvae and nymphs cannot escape.

WHAT IS AN INSECT?

The pupil who is to study insects should acquire a clear idea of what we mean by an insect. A full grown insect has three distinct parts to its body, namely, the head, the thorax (the middle part to which are attached the legs and wings), and the abdomen (the hindermost part). It also has a pair of "feelers" (antennae) which project from the head, three pairs of jointed legs, and usually two pairs of wings.



STAGES IN THE LIFE OF THE MOSQUITO. 1, THE ADULT; 2, THE LARVA; 3, THE PUPA.

Not all of the forms which the young collector finds in the pond or stream will be different *kinds* of insects but many will be only different *stages* of some growing insect. In some cases three different forms of one insect will be found, each of which differs so widely from the others that the beginner may not suspect that they have any connection with each other. Insects have from three to four stages in their growth from the egg to the

STAGES IN THE LIFE HISTORY OF THE DRAGON FLY. 4, THE NYMPH. 5, THE ADULT.

adult. The first stage is the egg. It hatches into the second stage, the Larva, which is usually a worm-like form and which is active in its habits, eats greedily, grows, and sheds its tough skin several times. The third stage, the Pupa, (not all insects have this stage) is a resting stage in which the larva, in a very changed form, passes some time before changing into an adult. In insects which do not have the pupal stage the second stage is called a nymph. In nymphs the wings begin to show themselves as little pads on the top of the thorax.

(TO BE CONTINUED.)

Lectures on Nature Topics

The editor of the REVIEW is in touch with persons in almost all sections of the country who are available for lectures that will help stimulate interest and arouse enthusiasm in nature work. These parties are sufficiently devoted to this work to give their service for a very little over expenses. Arrange for one or more in your own community.

Worcester Garden City Plan; Or, The Good Citizens' Factory

R. J. Floody

"Back to the farm," "Back to the soil," is the slogan of the social prophet of today. The soil is the source of wealth, means of health, basis of education, and condition of civilization. Indeed, man commenced to be civilized when he began to till the soil. What a strange and fascinating effect the soil has upon the human mind! Note when a load of loam or sand is dumped upon the street how quickly it is covered with little children. The prophetic finger of the age points to the soil or soil cultivation as the principal factor in the solution of our social ills. This has been clearly demonstrated in our experiment with what we have been pleased to call the Garden City Plan.

This Garden City Plan consists of a large group or city of little gardens, ten by twenty feet, with streets, boulevards, squares, etc., like a minature city. So far we have used dumps and vacant lots. Each child is charged the sum of five cents for his garden, given five packages of seeds, and he owns all he raises. The age range is from six to sixteen but those beyond these limits with adults also are given special permits, so that it is a community affair with all ages. There is a Zoo in connection with this juvenile city. Rabbits, guinea pigs, foxes, coons, white rats, white mice, etc., comprised this menagerie.

This city is well organized with a Mayor, City council of seven members, Commissioner of Gardens, of Streets, of Tools, Water Commissioner, etc., together with forty Police Officers. The latter were for the purpose of protecting the property from thieves and bums. In the central square waves "Old Glory," reminding the many nationalities of their country and the laws it represents.

This work was independently started five years ago under the auspices of the Worcester Social Settlement in the "Island District" of Worcester, Mass. This district is about two miles long and one wide, contains 22 nationalities, has over 20,000 children eighteen years and under, has a record of much drinking, poverty and crime. After three years of successful work, another garden was opened among the Italians in the East side on Shrewsbury St. Last season we had not only the above gardens but two on the West Side among the American class of people, making four garden cities in all. It worked with equal success among

all. In the four Garden Cities of last season we had about 1,000 young gardeners, each entrusted with a vote.

The plan was first started for the purpose of solving a problem. Many boys of the various nationalities in the District made it a practice in the summer to frequent "Yankee Hill" and help themselves to the fruit there so that many owners failed to get the benefit of their crop. Without money and without any other model or plan to follow, we started. "Dead Cat Dump" was secured in the vicinity and operations commenced. The children worked hard to clear it of the "sticker bushes" as they called the burdock. Now although this was real work, it did not seem so to the crowd of children. We made bon-fires of the sticker bushes and this was a source of great amusement which served to keep up the interest and enthusiasm. We are quite convinced that work is a good thing for a boy. Play and playgrounds are all right if they do not go to extremes. We teach the boy that the business of life is work with play at intervals. Some of our gardens have a playground along side, so that workgrounds and playgrounds go together.

After the forest of burdock was really cleared off and burned, then came the herculean task of removing the tin cans,

HELL-HOLE DUMP, 1911.

pans, pots, crockery, glassware, etc. They were raked in little piles, shoveled into wheelbarrows and carted away. It is no exaggeration to say there were whole train loads of rubbish to be removed by the city teams. The plot was then filled up with street sweepings until it was as level as a floor. It was staked off into gardens ten by twenty feet with a street on two sides of each garden. The streets were four feet wide, except the main walks, these were six feet wide. The children were assigned their gardens as they paid rent for them with a nickel. Each received in return a red card with name, number of garden and five packages of seeds. Under the supervision of a director each planted his seed and raised a crop. Stealing was no joke now. A new idea dawned upon them. How were their gardens going to be protected and who was going to do it? No fence was around the lot and hundreds of persons passed through daily. No one gave any encouragement. It soon dawned upon the young farmers that the property was theirs and the responsibility was put upon them to protect it. So then they organized with Mayer, Council, Commissioners and forty Police Officers. It was no play affair but real responsibilities meaning much hard work. They assumed their offices with a great deal of seriousness and did their work

LINCOLN GARDEN CITY. SAME AS OPPOSITE CUT, EIGHT WEEKS AFTER.

faithfully and with great success. When authority is delegated to the boy, it arouses his self respect, awakens his manhood, and touches the spring of action. We have found this the greatest element to awaken a boy and and head him toward respectability. A little boy was caught stealing pears from a neighboring tree. He was arrested and fined a penny by the boy cops. He paid his fine and next day the writer asked him how he would like to be a cop. He said he would like it very much. He was told the city council would have to elect him but we could appoint him a watchman. He wanted that position. We then gave him instructions "to watch that tree and if you see any kids stealing you run and catch them." So this little fellow watched the tree until the crop was harvested in the fall, the very tree he stole from himself the day before he was made a watchman.

This system had a fine effect in another direction. In every city in this country so far as we know the boy is the enemy of the police. This is a serious thing for disrespect for the law officers, finally leads to disrespect for the law and then follows crime. But here the boy is the friend of the police and works in harmony with them. Many cases could be given where the boys were of invaluable service to the city police. It is a great thing in determining the bent of a boy's nature to have a little experience in enforcing the law. Even if it is only for a little while, the good effect will always stay with him.

The Zoo was a very interesting feature in connection with our Garden City work. Cruelty to animals was quite a common thing in the community when we first commenced the gardens. I personally know of a little boy driving nails through a kitten's paws and nailing it down to a board and then stoning it till it died. What are you going to do with a boy of that kind? Tell him he is a very bad boy! He had been told that a thousand times. Tell him to be a good boy! He then takes you for a tenderfoot. We saw the only thing to do was to get some animals and have the boys feed and care for them, and they are sure to pet them. We secured rabbits, quinea pigs, foxes, coon, white mice, white rats, pigeons, etc., and gave them into the hands of the boys to feed and care for. They had no sooner commenced than they were the pets of the whole community. They would not hurt them themselves and would not allow anyone else to do so. Now we have a Band of Mercy 800 strong, one of the largest in the world. There has not been a single case of cruelty to animals for months and months in the whole district. It is a matter of interest to know how this Band of Mercy was first or-

ganized. Our pet coon got out one night and was found dead on the street the next morning, killed either by a man or a dog. Some of the children cried over their loss. They decided to give him a good burial. They secured a cracker box for a casket, placed the remains within, covered it with a lid on which was written with chalk the words "AT REST," and buried it in a grave three feet deep, the grave was sodded, top covered with flowers, etc. The little Mayor said: "Boys, we will start a Band of Mercy and the kid that don't join it, we will make him." Before this, we had endeavored to start one in the Settlement House, with the assistance of a representative of the W. C. T. U. and after her talk she enquired if any would like to join the Band of Mercy. Oh, yes, they would all join. They were given a paper for signatures and quite a number signed. I examined that remarkable document and found such names as "Tommy stick in the mud, 23 Skidoo St.," etc. It was a laughing stock and resulted in failure. But when this pet was killed, it was another thing and it took hold of them.

Each child is required to give ten hours in unselfishly helping someone else in the gardens. It was pathetic to see a little lame despised Jewish boy trying to work on his garden, and to

notice a Polish boy, then a French boy, a Swede and an Irish boy, all join and help the poor little fellow. This was real brotherhood, just what the system aimed to accomplish.

This method has been called the "Good Citizen's Factory" because of its effect in training for good citizenship. In the first place, it teaches the boy to work, to produce something and become a property holder. It teaches him grit, thrift, self-reliance. A few days ago we asked a little boy if he was going to get a Thanksgiving dinner from the police (a charity dinner). He blurted out indignantly, "No sir, I can raise my own vegetables. I had a garden this year." From the statement of several of the police this system has reduced juvenile crime fifty per cent in the immediate community. The late Captain Ranger of the district and also Officer Curran stated to the press that the Garden City work had cut crime in two. Last year Chief Matthews estimated it reduced juvenile crime ten per cent over the whole city. Before we started our garden work, the neighboring boys used to run away with teams, as near as we can judge about twenty were driven off. After the gardens were started not one team was taken. The attorney for the Licensed Pedlars' Association stated before our committee that before we started operation, he used to have five or six complaints a week, but since the gardens were started not a case in six months.

Besides this, it has beautified the community in which it was located, raised the health rate 72 per cent in the "Island District" in three years, produced according to the estimation of the Judges $2,341.00 worth of vegetables, enhanced the value of property $50,000.

The Taming of Wild Animals

E. A. Lewis

Ever since I can remember, I have been one of those who enjoy having a pet of some kind; and, instead of out-growing that desire as I have grown older, it has become more pronounced. Recently it occurred to me that other young people would, perhaps, like to know how to go about the taming of a wild animal.

First obtain a young one. Sometimes old animals can be tamed but the chances are much against it. One always feels like a murderer when he takes some little wild brother away from his home and it dies. Mature animals have had their liberty so

long and have become so accustomed to one way of living that it is very nearly impossible for them to get used to the changed conditions of living in captivity. A young one doesn't seem to mind so much. When he finds he isn't going to be hurt he usually settles down and takes things quite as a matter of fact. The only way in the world to make him feel that way is to be exceedingly gentle with him. Even if he bites, you must be quiet. Move quietly and without demonstration. Let every move be just as little apparent as possible. Do not put your hand into the box at first. It will frighten the animal and he will attack you in self defense. Then you will jerk the hand out with a flourish and a scream and scare poor bunny into fits. Poke a stick in first. He will attack it, of course, but he will presently find that things coming in that way do not hurt him and will just drop his war like attitude of his own accord. But be sure that absolutely no demonstration is made with the stick. Next in-

terest him with something in front of the cage and very, very quietly reach a hand from behind and just barely touch fur or feathers. He will probably whirl on you with all the energy of mortal fear. Be ready to move the hand quickly and quietly to a place of safety and then be perfectly quiet so as not to disturb or frighten him more.

Take pains to see that his cage, his food, and his water are always perfectly clean. When he takes the first nibble of food in your presence, you may feel relieved for your work is more than half done.

Following these principles I tamed a sparrow hawk a year ago last summer so that in less than a week I could hold him on

my hand and, with a little piece of meat as an attraction, carry him out in the yard, as you can see in the picture.

My present pet is a muskrat which one of my pupils brought to me on December 20, 1911. On the morning after I had had him three full days, I took him out of his box to get a picture. Pictures No. 1 and No. 2 were the result though he bit me in the process of getting them. I simply cleaned the cut with hydrogen peroxide and continued my picture getting. Picture No. 3 was made the morning after I had had him a full week.

A Seventh Grade Soil Experiment

C. F. Phipps.

The University of Chicago, The School of Education.

That the work in nature-study and elementary science should be progressive and correlated in the grades, is a fact well recognized by teachers today. In the upper grades of the Elementary School of the University of Chicago, different phases of elementary science are presented,—hygiene in the sixth, electricity in the seventh, and simple scientific phenomena of the home and community life in the eighth. To correlate the science work of the seventh with that of previous grades it has been found well to use the garden work as a basis of transition. If the children have had garden work in the previous years it is instructive to take up a brief experimental study of the soil, to ascertain approximately what the constituents of the soil are, and its relation to plant growth.

Let the children bring in samples of school garden soil and weigh very carefully, in an iron pan, a small amount, perhaps 100 grams. It is much more interesting if each child can work out his own experiment, but if the class is too large, or the equipment insufficient, a demonstration of parts of the experiment by successive groups of two or three, or even by the teacher, will be found profitable.

First, place the pan of soil on a ringstand and heat very gently to dry out the moisture. If there is time it may be dried by setting aside for a day or two and stirring occasionally. As the soil dries it becomes much lighter in color, and most of the small lumps break up in the process. The stirring may be done with an iron wire or glass rod, preferably the former because of the probability of the glass chipping off as it becomes hot, and adding to the weight of the soil. The amount of water, in grams and cubic centimeters, may be determined by a second weighing.

To ascertain the amount of organic material consisting of decayed animal and vegetable matter, the soil is next heated very hot, and stirred at intervals of a few minutes. This strong heat should be applied until no further odor can be detected, and no smoke or sparks seen. The soil will probably then be grayish in color, and have the appearance of fine dust mixed with sand and gravel. By another careful weighing the amount of organic matter is obtained. The soil should then be shaken successively through three sieves of different sized meshes, the largest mesh be-

ing about an eighth of an inch square, the next about a sixteenth of an inch, and the third small enough to catch the medium sized sand. The gravel is caught in the first sieve, the coarse sand in the second, and medium sized sand in the third. That which passes through the final sieve may be called a mixture of fine sand, clay and silt. Each of these ingredients should be weighed and noted.

Separate the fine sand from the clay and silt by pouring water upon the mixture in a beaker or tumbler, stirring, and quickly but carefully pouring off into another dish the muddy water. Dry and weigh the fine sand left, and estimate the amount of clay and silt. This latter may be regained by evaporating the muddy water.

More interesting and helpful data may be obtained by finding the volume of the soil by means of a rectangular measure having a cross-section area of one square inch. The amount of water contained in one cubic inch of the soil may then be known, and the amount in a cubic foot estimated.

A permanent exhibit of the results of the experiment may be kept by placing samples, or actual amounts, of each constituent found in the soil analyzed, in small flat bottles and mounting on a large cardboard with suitable labels and explanations. The percentage of each material found may easily be worked out by the class, and the different weights added to see if the original 100 grams have all been accounted for.

The experiment may be repeated, using other soils taken from the home garden, the field, and other places, and a comparison of results made. If samples of the constituents found are placed in pots, and seeds, flowers or weeds planted in them and watched by the children from day to day, a lesson is taught concerning the necessity of water, organic material and other substances in the soil for growth of plant life. A record of the experiment with all data should be kept by the pupils, written carefully in notebooks, the training in accurate written expression proving most helpful.

This simple analysis does not of course take into account some chemical constituents of the soil so necessary to the growth of plants, but it serves several important ends, especially if the experiment is done by the pupils. Useful training in weighing is given, opportunity is afforded for developing the powers of observation and inference, and a much better knowledge of what soil is and its relation to plant growth is impressed upon the child's mind. This experiment may well be followed by other

simple ones on the water holding capacity of soils, and the lifting power of soils for water.

From the study of water and other soil constituents as types of energy, the class may be led to name other forms of energy, such as heat, light, electricity, etc. Then a more detailed study of any one of these topics may follow.

Editorial

The pessimist on American education need only attend a meeting of the Superintendents of the National Education Association to be transformed into an optimist. It was a fine crowd of men that filled to overflowing the audience rooms and the hotel lobbies at the St. Louis meeting February 26th to 29th. Eighteen hundred and more were there, representing the entire country. Far from being the traditional stoop-shouldered, anaemic pedagogues, they were on the contrary stalwart fellows with good red blood, alert, jovial, and aggressive.

It is evident that these men consider the instruction in agriculture a current topic of importance. The Round Table of State and County Superintendents devoted Wednesday afternoon to a discussion of agriculture in the rural schools, with such men as Earl Barnes, U. S. Commissioner Claxton, E. C. Bishop, and others, as speakers. Commissioner Claxton, in his evening address Wednesday night eloquently maintained that the subject matter properly connected with the farm is ample to tax the capacity, and develop both the mind and body of the child. He declared the rural school problem to be America's great unsolved educational problem. The responses to the toasts at the banquet in his honor on Monday night had much the same import. Wednesday afternoon the department of Normal Schools heard E. E. Balcomb discuss "The Place of the State Normal School in Agricultural Education." All Tuesday morning the National Committee of Agricultural Education were busy on agricultural topics, and the National Society for the Study of Education devoted half its report,—reviewed elsewhere in this issue,—to agricultural education in secondary schools.

This prominence of agricultural instruction at the winter meeting is only one of the many indications of the feverish interest in this subject. Seventy-five text books on agriculture for the common schools have already been published, twenty per cent of these within three years. Forty states require agriculture as

a subject for teachers' examinations. Half that number insist by law that it be taught in the schools. The Page Bill, carrying its millions of appropriation in aid of agricultural education is before the national legislature. Senate bill 109 in Kentucky provides for teaching agriculture in the common schools. Senate bills 7 and 118, and House bill 205 in Massachusetts have to do with the establishment of agricultural schools. House bill 152 in Mississippi provides for agricultural demonstration work in elementary rural schools. These few instances illustrate the fact that east and west and south legislatures are vying with each other to make speedy provision for agricultural instruction.

The whole movement seems but another expression of the realization that education is for the masses, not for the few. American schools are for all Americans all the time. Since our citizenship is prodominantly agricultural in its interests, the school must reflect this condition. Yet the movement in its haste throws large responsibility on the teaching force for popular demand insists on immediate results. Legislators are prone to curry favor with their country constituents by standing as champions of bills that make agricultural education mandatory, regardless of school conditions.

Fortunately scientific agriculture is merely the application of our scientific knowledge to the problems of the farm. The teacher who, as a graduate of any good Normal School, or even High School, undertakes to teach in a rural community, carries with him these days enough of the proper scientific attitude of mind and sufficient knowledge of the elementary laws of chemistry, physics and biology to materially help the community in the solution of its problems. He must be alert to see, unafraid to ask questions, apt to teach his elementary science by use of the materials that are common about him. This is the Nature-Study idea. Nature-Study with farm material is the best sort of agriculture for the grades. Let us remember, however, with it all, the caution that Whittier voices in his portrayal of farm life in the prelude to "Among the Hills":

> "How wearily the grind of toil goes on
> Where love is wanting, how the eye and ear
> And heart are starved amidst the plentitude
> Of nature.
> * * * * * * *
> And, in sad keeping with all things about them,
> Shrill querulous women, sour and sullen men,
> Untidy, loveless, old before their time,

With scarce a human interest save their own
Monotonous round of small economies,
Or the poor scandal of the neighborhood;
Blind to the beauty everywhere revealed,
Treading the mayflower with regardless feet;
For them the song sparrow and the bobolink
Sang not, nor winds made music in the leaves;
For them in vain October's holocaust
Burned gold and crimson, over all the hills,
The sacramental mystery of the woods."

News and Notes

The Chicago Nature-Study Club, Miss Emily C. Westberg, 911 Roscoe Sec. secretary, has been enjoying some lectures this winter as follows:

February 10th,—*Aquaria for the Schoolroom.* F. C. Baker.

February 17th,—*Window Gardening.* A. H. Cole.

February 24th,—*Beautifying Schoolyards.* Jens Jensen.

March 2nd,—*Trees for the Schoolyard, Street and Home.* J. H. Prost.

March 9th,—*Enemies of Trees.* J. H. Prost.

March 16th,—*Birds as Guardians of Trees.* Prof. R. M. Strong.

We have been following one rather potential line of work, that of placing on a sand and dirt table, 4x6, six to eight inches deep, a school house and yard in miniature. The buildings are made out of pasteboard in the art department. In the planning of the lawn, flower seeds, trees, etc., the principles of landscape architecture are borne in mind. Certain acreages are devoted to gardens and to a general scheme of beautification. In this way the children are brought to think of the beautification of their own school house and school yard. We have found that the interest developed around the sand table has taken expression in the beautification of the larger school home.

Yours sincerely,

Berkeley, Cal. C. A. S.

C. A. Steubenmiller has been elected a Director of the American Nature-Study Society by the New York Section.

NATURE ARTICLES IN THE FEBRUARY MAGAZINES.

Atlantic Monthly.—Animal Wit Indoors and Out. John Burroughs.

Scribners.—Cuzco, the Sacred City of the Incas. S. S. Howland.

Harpers.—Instinctive Activity in Animals. John B. Watson.—The Land of the Pine Barrens. Maude Radford Warren.

St. Nicholas.—The Story of Panama. Farnham Bishop.

Overland Monthly.—My Experiences in Fiz. C. S. Mullins.—Insects That Work and Fight for Man. John L. Cowan.

The Craftsman.—Pheasants, the Future Game Bird of America. Planting About the House.

DELIA I. GRIFFIN.

Craftsman.—A Garden City in Germany. E. E. von Bauer.

Journal of Geography.—Local Climatic Peculiarities in Their Relation to Intensive Agriculture. Eric R. Miller.

Journal of Geology.—Kauri Gum Mining in New Zealand. A. A. F. Penrose, Jr.

Mind and Body.—One of Philadelphia's Open Air Schools. G. E. Phelps.

Popular Science Monthly.—Modern Tenement Houses. J. A. Rawson.

E. C. CRECELIUS.

Book Reviews

Polar Exploration. By W. S. Bruce; New York, Henry Holt & Company, 1911. 75 cents.

This new volume in the Home University Library of Modern Knowledge is by the leader of the Scottish National Antarctic Expedition in 1902 and 1904. It is a very readable account of the astronomical, botanical, physical, meteorological and geographical features of the Polar regions. It aims to outline the essential facts and problems connected with Polar exploration, and its size has allowed for very little material in the line of narratives concerning famous explorers. Although based on the author's nine Polar voyages to Arctic and Antarctic regions, it deals with the problems in a very general way and gives proper attention to the observations of other explorers.—W. A. B.

The Sport of Bird Study, second edition. Pp. 284. $2.00.

How to Study Birds. Pp. 272. $1.50.

Both by Herbert K. Job. The Outing Publishing Co.

Any book on birds by H. K. Job is bound to be worth while. These two books are interesting and exceedingly profitable to the bird lover. *The Sport of Bird Study* is a series of accounts of adventures in the photography of birds, together with descriptions of their habits. It is systematized by taking the birds somewhat in the order of their classification. There is an added charm to the book because a pretty constant companion of the author in his experiences is "Ned", to whom he refers in the early pages of the book as follows:

"Out of school hours some of the boys, on their own hook, scour the fields and woods for miles around, and Ned is one of these. Young as he is, he has already come to know the birds wonderfully well, and he seldom meets one he cannot recognize, if only he has a good glance at it. There is keen rivalry among these boys as to who can see and identify the largest number of kinds of birds each year."

The book is splendidly illustrated with numerous photographs that can be appreciated only by one who has endeavored to "get" birds with the camera. There are numerous suggestive hints in the book as to how the success have been won, but this phase of the matter is left largely to the second book, *How to Study Birds.*

Here are chapters on "Learning Birds' Songs and Notes," "How to Find Birds of Prey," "Camera Hunting and Outfit," "Using the Ordinary Camera," and fifteen more, all making up a "handbook of methods, the embodiment of the author's thirty years' experience." This book is also well illustrated, and both text and pictures make quite clear how birds can be followed, studied, and photographed with quite as much zest as the sportsman has in killing them. A little experience in attempting to duplicate the author's results will convince the most ardent gunner that it is a much more taxing form of sport, and a much more exciting trial of human skill against bird wit to bag game with a camera than with a shot-gun, and it is Job's purpose to convince his readers that this is true.

Both books will be exceedingly valuable additions to every bird lover's library. The latter will be found especially helpful to the amateur naturalist who is ambitious to do photography, as the directions both as to equipment and methods of procedure are explicit and authoritative.

The Eleventh Yearbook of the National Society for the Study of Education.

Part I, Industrial Education: Typical Experiments Described and Interpreted. 124 pp.

Part II, Agricultural Education in the Secondary Schools. 113 pp.

The University of Chicago Press. Each part, 75 cents.

This report furnished the basis of some of the discussions of the society at the St. Louis meeting February 26th. Part II includes the following papers:

I. The Training of Teachers for Secondary Courses in Agriculture, by A. C. Monahan, Specialist in Agricultural Education, Bureau of Education, Washington, D. C.

II. The Vocational Agricultural School, by Rufus W. Stimson, Agent for Agricultural Education, Boston, Mass.

III. State-Aided Departments of Agriculture in Public High Schools, by D. J. Crosby, Specialist in Agricultural Education, U. S. Department of Agriculture, Washington, D. C.

IV. High-School Agriculture Without State Subsidy, by W. H. French, Professor of Agricultural Education, Michigan Agricultural College, East Lansing, Michigan.

V. Short Courses and Extension Work in Agriculture for High Schools:

(a) In the South, by H. F. Button, Director of the Manassas Agricultural High School, Manassas, Va.

(b) In the North, by F. R. Crane, University of Wisconsin, Madison, Wis.

VI. In Public High Schools Should Agriculture be Taught as Agriculture or as Applied Science? by

(a) William R. Hart, Professor of Agriculture, Massachusetts Agricultural College, Amherst, Mass.

(b) George F. Warren, Professor of Farm Management, Cornell University, Ithaca, N. Y.

The titles and authors are guarantee of the valuable nature of the discussions.

The Monkey Folk of South Africa, F. W. Fitzsimons. Longmans, Green & Co., 1911. Pp. IX + 167.

The author of this book is a Director of the Port Elizabeth Museum in Cape Colony. The style of the book is rather surprising at first, as it is written as if the author were merely a stenographer for the monkey folk, who tell their own story. The author's purpose is stated in the Preface. It is to help "our boys and girls to take a real live interest in the Creator's handiwork." The book is exceedingly interesting reading, and portrays the

life history and habits of many of the monkeys and their enemies. The photographs add to the value of the book. One cannot help but wish that the author's viewpoint could have been maintained without introducing so much questionable philosophizing on the part of the monkey people, who are telling their adventures. Thus, on page 138, a blue ape remarks, "You see, we lead a healthy out-of-door life, and we don't smoke and breathe bad air and eat rich food all day long, like you humanfolk do; so our blood is always pure, and our bodies are strong, so when we get wounded we recover very quickly." Again, on page 141, another blue ape criticises our human relations thus, "True, we gratify our various instincts, but we always do so in strict moderation. With all your boasted knowledge and wisdom a very great number of you are abject slaves to your animal instincts, which, with abuse, have grown abnormal," and later expresses its dream of immortality in the following language:

"I have now lived for three years and a half a lonely, miserable exile. I feel the time is not far distant when I shall depart this life to go to the happy hunting-grounds of my folk, in the realms of the spirit world."

The book lacks an index, which would add to the value of it. I was anxious to find if the author had made any observations on the language of the monkey folk, but could not find out until the entire book was read.

"All Our Folks Are In It!"

LITTLE BANDAR has been looking at Vol. I of the STANDARD LIBRARY OF NATURAL HISTORY. His folks *are* there, sure enough, with the other "kindred of the wild," whose photo portraits—after patient toil and with frequent danger—were gotten everywhere, from neighboring marsh and woodlot, or the far-off rim o' the world. To illustrate the enterprise with which this work was made, we may say that it contained an article (with photographs) on the Okapi (the newly discovered animal) by Sir Harry Johnston, the discoverer, long before the American Museum received a specimen. Pictures are there, too, of domestic creatures, from the most typical individuals obtainable.

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OFFICIAL ORGAN OF

AMERICAN NATURE-STUDY SOCIETY

Vol. 8, No. 5
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From R. O. Johnson's article in February, 1912, number, "The School Garden as a Center for the Teaching of Nature Study."

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From W. E. Castle's article, November, 1911, "Guinea Pigs."

From W. L. Oswald's article, January, 1912, on "Seed Testing."

Fig. 1 (Top)—Self-Colored English Guinea-Pig.
Fig. 2 (Middle)—Dutch-Marked English Guinea-Pig.
Fig. 3 (Bottom)—Albino English Guinea-Pig.

Fig. 4. Tripod Lens and Forceps Used in Making Purity Tests.

From Chas. D. Hall's article on "Farm Animals."

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VOL. 8 MAY, 1912 NO. 5

A Robin's Nest

C. W. FINLEY.

On May 15, 1910, a robin's nest containing four eggs was found in the crotch of a small maple tree at the south end of Jackson Park in Chicago. The nest was barely five feet from the ground, and the main branches of the tree were arranged, see the first figure, so as to make photographing it an easy task. (Fig. 1.) Near the tree was a thick clump of bushes in which one could secrete himself and, at the same time, have an unobstructed view of the nest. Although there was a graveled walk within twenty feet of it, the spot was little frequented by park visitors. The writer was at that time being initiated into camera

FIG. 1.—THE NEST IN THE CROTCH OF TREE AT LEVEL OF BOY'S HEAD. ROBIN IN THE TREE.

secrets and doing special work in bird study. From the above description it can be seen that here was an excellent opportunity to do work in both lines. To have done justice to this opportunity would have required being at the site with note book and camera for hours each day from the time the first egg hatched till the young had left the nest. But this was impossible because school work lasted until three o'clock in the afternoon and the location of the nest was a little more than two miles from the school building. If the time required to walk to and from the site and that consumed in taking a few photographs on each trip is considered, it is seen that little was left for a study of the habits of the birds.

FIG. 2. FEMALE ON THE NEST MAY 28.

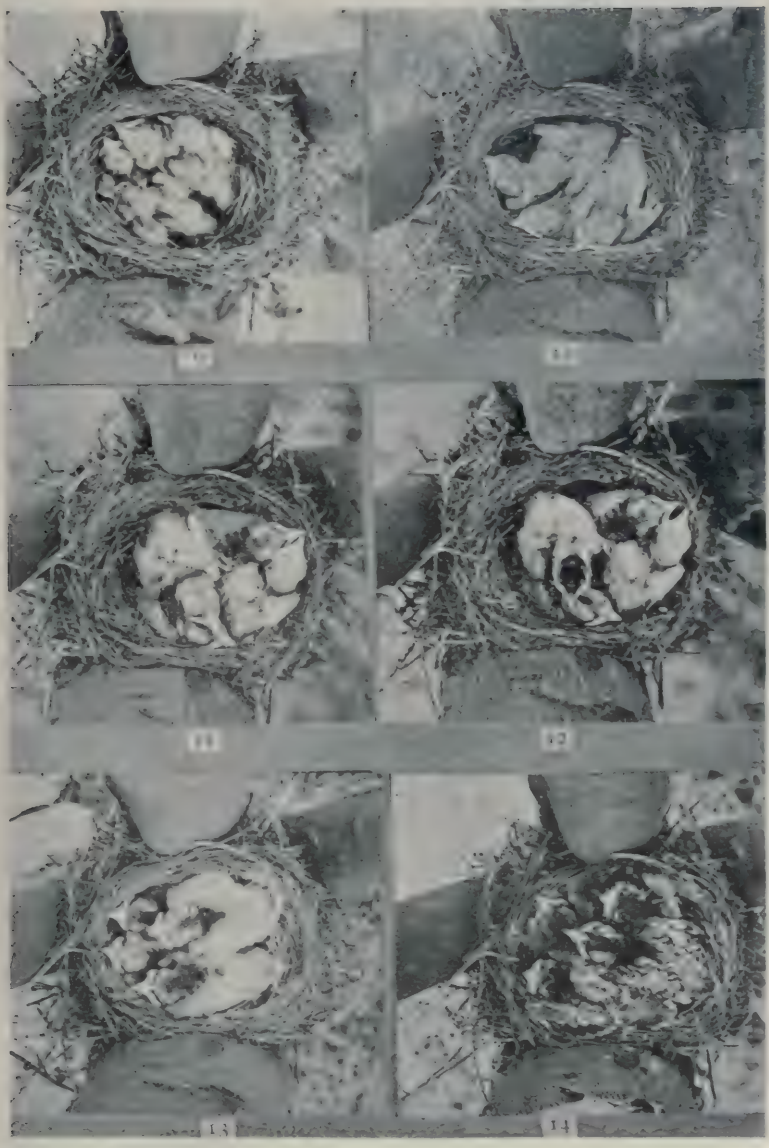
In the first few attempts at photographing the adults in various activities about the nest, the camera was set ten or twelve feet from the tree. In a few days, however, the birds became so tame that it could be placed within four or five feet of the nest. In several instances it was possible to change the plate holder and make a second exposure with the female bird sitting quietly on the eggs (Fig. 2). Her "fear of man" is seen in the first illustration, where she is perched on a limb within a few feet of the boys. In some of the later trips the nest was actually touched before she left it, in which case she would remain in the tree without making the noisy remonstrance which character-

ized her first reaction to our intrusions. In the general views the camera was manipulated by a large bulb to which was attached forty feet of special tubing. The photographs, showing the daily growth, were taken with the camera attached to the main trunk of the tree some three feet directly above the nest. In these instances a special apparatus devised by Dr. R. M. Strong, of the zoölogy department, of the University of Chicago, was used. This device consists of a semi-circular piece of sheet steel with a long straight flange at each end by which it may be strapped in any desired position to a limb or branch. The camera is attached to the center of the apparatus by means of a ball-and-socket joint which permits it to be pointed in any direction.

The work was started with the definite aim of (Figs. 3-14) obtaining daily photographs of the young from the day of hatching of the first egg to the time when the last bird had left the nest, and such views of the various nest activities of the adults as opportunity might permit. Although in direct contact with the elementary science work in the fourth grade of the Elementary School of the School of Education, University of Chicago, the writer had at first no intention to use the nest in connection with that work. The day after the first bird had made its appearance some of the children overheard a conversation in which this fact was mentioned. After dismissal that evening two boys were waiting at the entrance of the building with the request that they be permitted to go along to see the "baby robin." They were warned of the distance but the prospect of a four-mile walk seemed to add impetus to the demand. Their exploit and appreciation of the trip must have been well advertised, for on the next day there were so many applicants for the privilege that some of the pupils were asked to wait till a later trip. From that time on there was no necessity of making the trip alone. One afternoon there was a drizzling rain, but three boys made the long walk in order to see how the little birds were getting along and how much they had grown since last they had seen them. The nest and young became the property of the whole grade and the pupils making the trip would on the next day have to tell the rest, how the little birds were progressing.

As was said above, little time was given to a study of the feeding habits of the birds. It was learned (Fig. 15), however, that so far as this pair of robins were concerned the female did most of the sitting on the nest and the male did most of the feeding of the young. The young hatched in the following order: May 22, one, two on the following day, and one the next. The male

FIG. 3.—FEMALE AT THE NEST. FIGS. 4-8.—DAILY PHOTOGRAPHS MAY 22-26 INCLUSIVE.



FIGS. 9-14.—DAILY PHOTOGRAPHS MAY 27—JUNE 1.

FEMALE AT THE NEST MAY 24.

was loudest in his remonstrances to our intrusions, but he was the first to cease scolding and to fly from the vicinity. The main food given the young was earthworms. Very often the male after feeding the young (Fig. 16) would return again in about ten minutes with another mouthful of worms. Once it was discovered

MALE FEEDING YOUNG MAY 28.

that the last bird fed on one trip was the first one fed on the next. All of these things the children learned at first hand.

The night of June first there was a hard rain storm, and on the next trip the nest was found torn in halves with one part of it on the ground. The party made a systematic search of the neighborhood for the young birds but they were not found. This was a real calamity to the pupils and much sympathy was manifest for the lost birds. The next day one of the girls organized a searching party to look again for the unfortunate fledgelings. Nine pupils thus made the four-mile walk but found no trace of them. The children tried to pacify themselves with the idea that the young birds were probably large enough to take care of themselves.

The interest in birds thus aroused did not die with the destruction of the nest. Two of the girls and one of the boys had an opportunity, the following year, to make observations on another pair of nesting robins nearer home. Some of the parents spoke of the great interest in birds aroused in their children by the study of this nest. Two of the mothers said that they would have to study birds in order to keep up with their children. A study of a bird's nest such as was made here makes sermonizing on bird protection unnecessary.

The School-Home Garden

E. C. BISHOP,

I shall speak of that phase of work which may properly be called the "home-school gardening" or better the "school-home gardening" work.

The work in school gardening in cities where organization and funds permit close supervision of the work during the summer vacation is being so well carried out at a number of points that from the experiences there we can form some statements relating to procedure which may safely be accepted as workable directions. But the greatest problem of general interest now is that of the school garden in localities where the beginning of the summer vacation means practically the discontinuance of active, organized effort in the school garden. The problem of the school garden for rural and town and village schools is yet far from a happy solution.

Too many school gardens have had a most interesting begin-

ning and the interest has continued until the close of school. Then the story becomes sadder each day, as one by one the enthusiastic children become interested in something nearer home, and one by one the individual gardens are given over to the general management, which is no longer even general, and the general plots are "nobody's business," followed by nobody's interest, until weeds, sickly plants, disorder, loneliness and chaos settle down in disorganized despair, and the place that was a thing of beauty and worth becomes a sore spot, a nuisance to the community and a reproach to the teacher and to the school.

One neglected garden, which becomes an eyesore during the summer, does more toward discouraging good work in gardening than many seasons of drouth, floods, insect enemies, plant diseases and vicious weather spells. These interferences, if properly met, may be made to show the superiority of brain and industry over luck and carelessness. But scrawny plants, growing in a weedy, neglected school garden, stand as a monument of daily reminder to the effect that the school garden is a failure and the promotor of it a weak organizer, an inefficient supervisor, a faddist, an imbecile, or a misguided enthusiast whose inefficiency is as great as his desire to do something outside of the ordinary routine work in the established fundamentals of school work.

In schools where vacation work is not practical, the mission of the school garden should be:

First; an experimental plot for the study of germination of seeds and root and stem development to such degree as permissible during the growing season when school is in session.

Second; the growing of vines and shrubs, which may help to cover or shield the view of outbuildings and form a part of the school ground landscape work.

Third; the growing of such other flowers or plants as may be given a start in the spring, and by mulching or other prearranged care during the summer, blossom or bear results at the fall opening of school.

Fourth; an experiment, experience or illustration garden on a small scale, which serves to create the kind and degree of interest that will impel pupils to plant gardens of their own at home, where there is room, equipment, convenience and time during the season to plant, cultivate and harvest a crop of flowers or vegetables which are a credit, a profit and an encouragement to the child who produced them, and a comfort and pleasure to the home folks who share in them. This home work of the

child is the highest tribute which can be paid to the management of the school garden.

That teaching in school which does not find expression and extension thru the child in his home and in his life interests is poor teaching, and means ineffective work on the part of both teacher and child. Education which makes common materials a part of human life and human interests is good education. Earth materials have their highest value when translated into human flesh, mind and spirit. Our work with the soil, the plant and the animal should bring the elements of soil, plant and animal food to their highest form of service where they help to build the body, develop the mind and enrich the spiritual life of man —who learns to be their master instead of their slave.

Some of the most effective gardening work I ever knew was that done in a rural school district eight miles in the country, where the long, hot summer vacation had its usual effect on vegetation in a southern Nebraska school district. Here the teacher and pupils hauled stones from the creek, using the teacher's buggy, and made a few borders for little flower beds, where some flowers were planted in spring time and, thru mulching, grew during the summer and bloomed in September, after school opened. The same kind of work planted some vines which ran up over the old coal house and screened the outbuildings all summer, and during the winter, too, in some cases.

But the home gardening was what counted. Boys grew patches of pure bred corn, potatoes and other field crops, and girls had delightful home gardens of flowers and vegetables that were a source of profit to the owners and pleasure to the home and community. Germination boxes and germination beds at school told the story of how some of the flowers and vegetable seeds, and weed seeds looked when they first appear, thus enabling pupils to know which plants to pull out and which to protect in their gardens at home. Stories on how plants grow and how to care for them made strong English writers—and speakers. This kind of gardening is always a success, and it can be done by any live teacher in any school.

It is the reaction of the school garden that tells the story of its success or failure. Let us then plant the school garden with an eye open to the reaction in the home and the community as well as the reaction in the school. The growing of those things which bring pleasure or profit to the child rather than fanciful things which awaken only a passing interest is another feature which should be kept in mind. Results come from doing some-

thing which the child—and his parent, too—considers worth while, and in doing those things successfully. The lesson which requires the child to make a failure of himself in order to be successful in his lesson generally ends with the failure of the child to see the point, and a feeling on the part of the parents that there was no point.

State College of Agriculture, Ames, Iowa.

Mushrooms

C. H. KAUFFMAN.

Soon the warm rains of May and June will clothe our northern lawns and meadows with greenest turf. Then, some spring morning, as we glance out of our windows we will find dainty umbrellas raising their tiny tops above the green grass. These are among the first mushrooms of the season. Our neighbors may call them toadstools, but we do not mind, since we know that they are harmless for the most part, and that the really deadly ones grow about or in the woods beyond. Furthermore, if we know them each by name, we run out to find one old acquaintance after another, hidden away among the blades of grass, and we carefully bring them into the house and lay them on the table so we can admire their pretty shapes and delicate structure.

Each of these mushrooms has three main parts: the stem (stipe), the cap (pileus), and, on the underside of the cap, radiating blades, like knife-blades, are attached and set closely together, which are called the gills (lamellae). If we are lucky in finding several kinds on our lawn, (Fig. 1) and examine the gills closely we will find them to be of different colors, especially if the caps are fully expanded. In some the gills are white, and remain so. In others the gills become straw-yellow or brownish, perhaps smoky-purplish or black. Usually the gills are white in all of them as long as the mushrooms are still fairly young and unexpanded, but soon they begin to show the differences in color. Now it will be very interesting as well as entertaining if we cut off the stems just below the caps and lay the caps, gills down, on white sheets of paper. We cover these over with a tumbler or tea-cup and leave them for six to twelve hours. After removing the covers and raising the caps carefully, we will find a beautiful "print" on the paper, which is an

FIG. 1.—ON THE LEFT, HYPHOLOMA INCERTUM. ON THE RIGHT PSILOCYBE FOENISECII. A GROUP OF LAWN MUSHROOMS.

exact representation of the arrangement of the gills. This is called a spore-print, and is due to millions of tiny microscopic spores, like globules of dust, which have been produced by the gills. The production of these spores is what gives the gills of the different kinds a different color when the caps are fully expanded. The spores are matured even after the mushrooms are picked, and when ripe fall off on the paper. These spores are believed to be able to grow if they fall on the ground in favorable places where they eventually produce a new crop of mushrooms. Now, if the spores are white, the gills will remain white and the spore-print will be white and will scarcely show on the white paper, so we use black paper to make white spore-prints.

If we have paints and a brush handy we may set our mushrooms upright, sketch them and try to reproduce them in a colored picture. Most of those which grow on the lawns and fields are not so brightly colored as those which grow in the forests, but it is a good plan to begin with those near by. If we have a Kodak we may want to photograph them. Young folks will find it fun to snap-shot the different kinds growing on their lawns in order to make a collection of photos of their mushroom acquaintances. They can be photographed out of doors showing where they grow, as in the photograph shown in Fig. 2, or, if the specimens are not too small, they can be

FIG. 2.—COPRINUS MICACEOUS (THE LITTLE INKY-CAP). NOTE THE LINES RUNNING UP AND DOWN THE CAP.

set in a row with the base of the stem pushed into a pin the head of which has been cut off, as in our photograph. (Fig. 4.)

Perhaps someone will now ask whether it is safe to touch them. Are they not poisonous? Oh, yes! There are poisonous ones, but it is always safe to touch them. As long as you do not take them into your mouth or swallow pieces of them, you can touch every kind of mushroom or toadstool—if you prefer the latter name—that grows. The poison does not enter the skin as does the poison of the poison-ivy. But we will speak of this again.

We will now begin to look for other kinds growing elsewhere. One of the commonest kinds grows around stumps or the base of trees. This has black spores when expanded, and when old the gills turn into an inky fluid. They are called the "Little inky-caps," and come up in dense clusters which push thru the ground at the tree or stump. Sometimes they appear to come up thru the grass as in our illustration (Fig. 1), but if we dig down into the ground we usually find old stumps or roots there. These are edible and are often collected as fast as they appear by those people who eat them, so that unless one gets up early in the morning, he may find that his neighbor has been there before him.

There are three kinds of "Inky-caps" which we can eat. Besides these there are several more which every farm boy is acquainted with because they come up on the manure-pile out

in the barnyard, always appearing at night and looking their best at sunrise, while by noon they have all shrivelled up. But these are not eaten. The "Little inky-caps" of which we were speaking, have delicate glistening particles on the top surface of the cap which is tinged slightly with reddish-brown. Tiny furrows run up and down the surface, and, when old, the cap splits at the margin, as do the caps of most of the "Inky-caps." The "Middle-sized inky-cap" appears in similar places, but the flesh of the cap is thicker and the color is gray; at the base of their stems there is usually an irregular small ridge which runs around the stem, by which we may recognize it. Finally, there is the "Large inky-cap," which is often four to six inches tall, and before the cap is expanded it looks like a large oblong egg mounted on a stout stem; but it is not smooth like an egg-shell, for it is covered with shaggy scales. Hence it is often called the "Shaggy-mane" mushroom. They sometimes come up on our lawns if we keep them well manured, or we may find them by the road-sides and even on piles of horse manure. If we cut them open at the right stage we may find the most beautiful shades of pink and purple within, but when old the gills turn black and become a mass of inky drops. It usually requires very heavy spring rains to bring out the "Shaggy-manes," but when they do appear one can often get a peck or more at a picking.

But we must not keep our eyes too close to the ground. Perhaps if we are fortunate as we pass some old elm or maple tree, we may see a cluster of white shelf-like growths jutting out from the limb or trunk of the tree just out of reach. These are probably the famous "Oyster mushrooms." (Fig. 3) The shelves are soft and fleshy, convex above, and the gills are large and broad. These mushrooms have something of the shape of a large oyster-shell attached sideways, and measure four to six inches from side to side. They are among the most delicious we can find if we are looking for a meal. We climb up the tree, cut them off with a sharp knife and carefully wrap them in clean tissue paper which we always carry in our basket when we go mushroom hunting. We do not care to go further that day, because two or three of these shelves will make a nice mess for an ordinary family. We take them home, wash them carefully, lay them on a cloth to drain and then cut them into pieces the size of a quarter dollar. We prepare some bread or cracker crumbs mixed with egg, cover the pieces thoroughly and fry them in butter. This dish is enjoyed by almost everyone and

FIG. 3.—PLEUROTUS OSTREATUS (THE OYSTER MUSHROOM). THE WHOLE PLANT IS WHITISH. THE GILLS RUN DOWN THE STEM.

is a good introduction to mushroom-eating for those who wish to add something new to their spring and summer menu-card. The oyster mushroom, if found up on the tree, can not be confused with any of the deadly ones.

And now we will suppose that it is Saturday and that there is no school in session so we can take a longer trip. Of course we must have had plenty of rain. We know of some sheep-pastures, so we make our way across the fields and meadows, our basket on our arm, and with plenty of clean tissue-paper cut into foolscap size so that we can wrap each kind separately. If we want to photograph any of them after we return we also take some empty tin cocoa boxes in which we can place the fragile ones and keep them upright and uncrushed. In the pastures we look carefully for rounded white caps which hug the ground closely. The mushroom we are searching for is the so-called "Meadow mushroom." If we find any, we dig carefully below it so as to get stem and all. The stem is sometimes

rather deep in the ground and it is necessary to dig it out in order to avoid making mistakes and so picking a poisonous one. If we have found the right one, we know it by a fringed collar which encircles the stem and by the color of the gills which are at first a bright ribbon-pink. It is sometimes called the "Pink-gilled mushroom" or the "campestris," etc. Its real name is *Agaricus campestris*, and many people call it "the mushroom" and all the others "toadstools," because they think it is the only kind good to eat. But this is of course a mistake, for a great many kinds that people call toadstools are fine eating. A number of other mushrooms, besides the meadow-mushroom, have pink gills, but often the shade of pink is different and there is no collar on the stem. Such, that have no collar, should be let alone by the beginner, except just to make pictures of. The "Meadow mushroom" is very fine eating and many people are acquainted with this fact, so that your journey to the sheep-pasture may be in vain. You will then only find some old specimens which were not wanted. You can tell the old ones by the fact that the gills have turned dark brown, almost black-brown. The gills of the other kinds with pink gills do not change dark in this way, so that this will help you in knowing the "Meadow-mushroom."

Next we will cross a ploughed field where we will probably come across some very large and stout fellows which look very much like the "Meadow"mushroom. If we examine them, however, we will find that the gills of the young specimens are not nearly as bright pink as those of the former, and if we bruise them on their white cap or on the base of the stem the injured place turns yellowish. So we know that we have found the sister of the "Meadow mushroom," and this is called the "Field mushroom" or "Ploughed-ground mushroom." It is also good eating so we place it in our basket. Now it may be, if we are just beginning to collect mushrooms to eat, that we are not very sure after all whether they are the ones we think they are. So if we are going to show them after we get home, to someone who knows mushrooms of all kinds, we carefully dig up the stem and all and wrap them in our tissue-paper, because our expert-friend will want to see the whole mushroom before he is willing to give us his opinion. But if we know surely what we have, we just take the caps because we are not going to cook the stems anyway unless the plants are still very young. In the young condition, they look just like little balls from the top, in which stage they are called "buttons," and they are then

very tender. When they are in the button stage, however, we are likely to pick up deadly ones if we are not well acquainted with them, because we cannot see whether the gills will become pink or not. Usually, however, after a little practice, we can tell by the firm feel and in other ways that we have the right ones.

And now we will go over to the nearest woods to see whether we can find some other kinds. Before we climb the fence

FIG. 4.—AMANITA VERNA. (THE POISONOUS AMANITA.) NOTE THE CUP, RING AND WHITE GILLS. THE "BUTTON" IS COVERED BY THE LAYER WHICH BECOMES THE CUP.

separating the pasture from the woods, we will walk along its edge, and if it is late enough, say the Fourth of July, we may suddenly come upon some mushrooms which are pure white, or, perhaps, they may have a sort of smoky-brown cap and be white on the gills. But the snow-white ones look the prettiest. They have long and rather stout stems, too, and look as if they were not afraid of being picked, instead of hiding close to the ground like the meadow mushroom. We look at them carefully before picking them, because it is a shame to spoil such beautiful objects. Their white, rather large caps are expanded and the gills are pure white. The stems seem to have thin curtain-like rings near the top, and if we bend over close to the ground we may see the stem sunk into what looks like a cup. If we dig deep enough and carefully lift the stem and cup from the ground we can see that there is actually a sort of thimble-shaped white sheath around the bottom of the stem. And now we know that this beautiful mushroom is one of the poisonous *Amanitas* and that if we eat it we invite death in the terrible form of convulsions. The same is true of the one with the smoky-brown cap if we should find it, for it also has white gills, a curtain-like ring and a cup on the stem. Fig. 4 shows the white *Amanita* which is sometimes called the "Destroying Angel." There is also a large yellow *Amanita* as well as some small yellow ones, which are equally dangerous. We now wrap our white specimen carefully in tissue paper so that when we place it in our basket with those we are going to eat the pieces may not become mixed with the good ones. In this way it is perfectly safe to pick them and take them home to show to our friends.

And if we now climb the fence into the woods, we may be able to find quite a few more of the poisonous kinds, as well as a great many others which grow abundantly in the woods during rainy weather. In fact, we may find so many different kinds that it will be well not to try to learn them all at once. It is much better to learn a few kinds at a time and become thoroughly acquainted with them before going further; and if we are going to eat them, it is well to go slowly and keep on safe ground. Many people have rules, which they believe in, to separate the edible from the poisonous. But beware of rules. They all have exceptions. Mushroom rules are not any safer than would be a rule which said that all people with black hair make good friends.

"But," I hear some one say, "if they are poisonous then they

must be toadstools and not mushrooms." Well, we shall not quarrel about that, but you see, a mushroom-expert knows that there are hundreds of kinds, and that of these a great many kinds can be eaten without harm if one's digestion is normally good, and hence he makes no difference between mushrooms and toadstools, but calls them all "mushrooms." Some are poisonous, some are bitter, some are too small to eat, some are tough or woody, others too dirty-looking, and yet there still remain enough kinds that are good to eat to keep him supplied from Spring till the snow covers the ground.

And so we can take trips into the woods and fields all summer long and way into the autumn after the frosts. If there is plenty of rain we will find more and more mushrooms as the season advances. In September, especially, if we go to the right places, such as woods which are hilly and have little ravines, and streams running down in them, we may often fill our baskets with twenty or more kinds in one afternoon. In fact, there are so many kinds it would take a large book to tell all about them. Some of them are beautifully colored, and especially in the summer or fall mushrooms can easily be found whose caps may be red, yellow, blue, green, brown or all shades of these colors; and if you like to paint you will find no prettier objects for your pencil.

So far we have only spoken of those mushrooms which have an umbrella-shaped cap. But there are still some with other kinds of shapes, which we can do no more than mention. For instance, there is the "Puff-ball." The little balls, hardly an inch in diameter, which sometimes come up on your lawn and which are white when they are young, inside as well as outside, but become filled with a brown or olive dust when old and dry, are puff-balls. In the pastures you will find some which are as large as a croquet-ball, and if you hunt long enough thru the woods you may find the "Giant Puff-ball" which grows as large or larger than your head. All these are pure white inside when they are young, and you can always eat the puff-balls as long as they are pure white on the inside, nor will you be able to make any mistake if you first break them open to see that the interior is uniform in appearance. Later the inside becomes dark-colored and powdery from the spores, and when you press on them you can then see the "puff."

If we go mushroom-hunting quite early, say the beginning of May, we may find the "Morel." This has a stout hollow stem, with a peculiar, globular, conical or cylindrical top, whose sur-

face is sometimes honey-combed in appearance, at other times composed of large ridges and furrows running irregularly up and down. This peculiar top is called the cap, but is very different from the caps of those we discussed at first. This cap is buff, or dirty-straw-color, but becomes brownish as it becomes older. The "Morels" are perhaps the most delicious mushrooms that we have, and the first dish of them in the early spring is as satisfactory to the mushroom-lover as is the first blue-bird to the bird-lover.

So now let us get ready our baskets and paper and boxes, for soon the mushroom-season will be here and we can then make a beginning at the study of this wonderland about us, with which so many of us are scarcely acquainted.

University of Michigan.

The Insect Life of Pond and Stream

PAUL S. WELCH.

University of Illinois.

PART II.

The following key is intended to provide for the young collector a simple means of identifying the common insects of ponds and streams.

ADULT INSECTS.

With fully developed wings. (Some adult Water Striders and Marsh Treaders are wingless; the wingless adult Water Strider usually has an abdomen about as long as the thorax while the abdomen of the young is much shorter; the wingless adult Marsh Treader has a rigid body and three-jointed tarsi while the young has a very soft body and one-jointed tarsi.) I.

IMMATURE INSECTS (LARVAE AND NYMPHS).

Without fully developed wings. II.

I. Adult insects.

A. Insects living on the surface of the water.

1. Insects with narrow dark bodies and long legs.
   a. Second and third pairs of legs longer than the body; head much shorter than the thorax; movements quick and rather jerky. WATER STRIDERS (Fig. 6).
   b. All of the legs shorter than the body; head as long as the thorax; movements slow and never jerky. MARSH TREADERS (Fig. 7).
2. Insects with oval black bodies; second and third pairs of legs very short; the first pair much longer; movements often rapid and confused. WHIRLIGIG BEETLES (Fig. 8).

B. Insects living under the surface of the water; are free swimming, and are often seen hanging at the surface.

1. Fore legs held forward in a grasping position.
   a. Body broad and flat.
      (1.) About 2¾ inches long and 1¼ inches broad.
         LARGER GIANT WATER BUGS (Fig. 9).
      (2.) A little less than one inch long.
         SMALLER GIANT WATER BUGS (Fig. 10).
   b. Body long and narrow; a long slender breathing tube on the end of the abdomen. WATER SCORPIONS (Fig. 13).
2. Fore legs not held forward in a grasping position.
   a. Front wings soft and membranous.
      (1.) The back is shaped like the bottom of a boat and the insect swims upside down. BACKSWIMMERS (Fig. 15).
      (2.) The back is flat and the insect swims right side up.
         WATER BOATMEN (Fig. 14).
   b. Front wings thick and horny.
      (1.) Fringe on the hind legs only; color black with the sides bordered with yellow. DIVING BEETLES (Fig. 12).
      (2.) Fringe on the second and third pairs of legs; color black, no yellow margins. WATER SCAVENGER BEETLES (Fig. 11).

II. Immature Insects.

A. Insects usually with wings showing as little pads on the thorax, Nymphs.
   (1.) With long bristles on the end of the body.
   a. Two bristles on the end of the body; tufts of thread-like gills at the bases of the legs. STONE FLY NYMPHS (Fig. 16).
   b. Two or three bristles on the end of the body; flat leaf-like gills on the sides of the abdomen. MAY FLY NYMPHS (Fig. 17).
   2. No bristles on the end of the body.
   a. Three broad leaf-like plates on the end of the body.
      DAMSEL FLY NYMPHS (Fig. 20).
   b. No leaf-like plates on the end of the body.
      DRAGON FLY NYMPHS (Fig. 4).

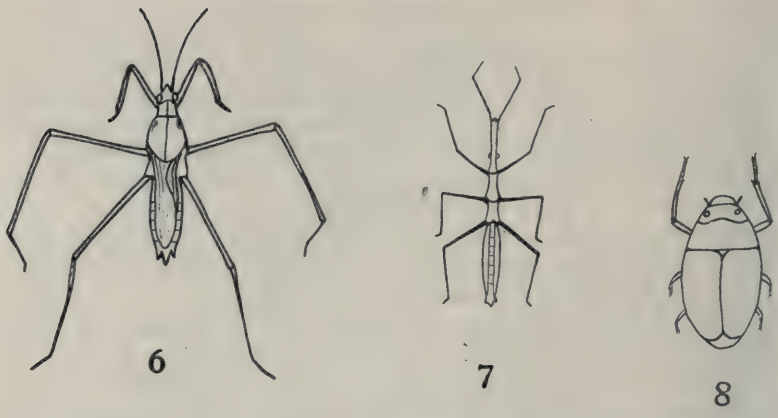
B. Insects with no wing pads on the thorax, Larvae.
   1. Without true jointed legs.
   a. Attached to rocks, twigs, leaves or grass in rapidly running water.
      BLACK FLY LARVAE (Fig. 19).
   b. Not attached.
      (1.) Thorax larger than the remainder of the body.
         (*a.*) End of the body forked; head smaller than the thorax.
            MOSQUITO LARVAE (Fig. 2).
         (*b.*) Two flaps on the end of the body; thorax and head very large. MOSQUITO PUPAE (Fig. 3).
      (2.) Thorax not different from the remainder of the body.
         (*a.*) Color red; ½ to ⅝ of an inch long.
            BLOOD WORM [Chironomous larvae (Fig. 26)].
         (*b.*) Color dirty white or brown; 1 to 2 inches long.
            CRANE FLY LARVAE (Fig. 24).
   2. With true jointed legs.
   a. Living in a case covered with little stones, small twigs, or various kinds of debris. CADDICE FLY LARVAE (Fig. 25).
   b. Not living in a case.
      (1.) With tapering projections on the abdomen.
         (*a.*) 2 to 2½ inches long. DOBSON FLY LARVAE (Fig. 23).
         (*b.*) Less than 1 inch long. WHIRLIGIG BEETLE LARVAE (Fig. 18).
      (2.) No projections on the abdomen.
         (*a.*) Abdomen slender; no teeth on the strong jaws.
            WATER TIGERS [Diving Beetle larvae (Fig. 21.)]
         (*b.*) Abdomen rather plump; teeth on the jaws.
            WATER SCAVENGER BEETLE LARVAE (Fig. 22).

The Water Striders (Fig. 6).

Among the very first insects to appear in the Spring are the Water Striders. They are oval, dark-bodied insects with long spider-like legs and are to be seen on almost every pond or stream, running about with swift nervous movements over the surface of the water. They are held up by the surface film in which their feet make distinct dimples. These dimples, on sunshiny days appear as shadows on the bottom. Often they rest idly on the surface and drift with the current or before the breeze. If the young collector examines his collecting grounds carefully he will probably find them in every aquatic situation, in open water, or among the half submerged vegetation, or among the floating lily pads, or even running over the muddy banks close to the water's edge. The second and third pairs of legs support the body while the first pair, which the beginner may not recognize as legs, are used as grasping organs. The immature Water Striders are like the adults except that they are a little smaller and the abdomen is very short. Watch these insects with an opera or field glass and many facts about their behavior will be discovered. They prey upon other small insects, seizing them with the fore legs, piercing them with their sharp beaks, and sucking their juices. They are usually very shy and quick, and in order to collect them one must approach them very cautiously and quietly and then scrape them up with a sudden dash of the net which should just sweep the surface of the water. Watch that they do not leap out of the net before they are secured. Carry them home in a closed pail containing some wet water weeds. They may be drowned if shaken about in a closed pail of water. Handle them with care as they can inflict rather severe pain with their sharp beaks. They are easily kept in an aquarium which has sides high enough to prevent them jumping out. Feed them by throwing in a few dead flies. Do not use flies which have been killed in a cyanide bottle, as they are poisonous. Do not put larger water insects of a different kind into the same vessel.

The Marsh Treader (Fig. 7).

This queer little insect is usually overlooked since it is only about one-half inch long, dull dirty brown in color, and quiet in habits. It is found at any time during the Spring or Summer on the surface of the water or on the soft mud of the shore where there are plenty of water plants growing. It seems to prefer swamps and stagnant pools. It has long thin legs, hair-like



ADULT INSECTS.—6, WATER STRIDER; 7, MARSH TREADER; 8, WHIRLIGIG BEETLE.

antennae, and a curious, long, cylindrical head on the sides of which, and well back from the front end, are the eyes, while on the lower side is the deadly beak. They feed upon insects that fall into the water. The writer has collected them by making long sweeps with the net among the water plants just at the surface of the water or by dragging the open mouth of the net swiftly over the surface of the mud near the water's edge. In the aquarium, fed them on flies and mosquitoes.

THE WHIRLIGIG BEETLES (Fig. 8.)

At almost any time from March to October these oval, blackish, surface beetles can be seen on almost every pond or sheltered nook of quiet streams. They always occur in groups which may be small or large. Sometimes the group will number about ten, while again the writer has seen groups which must have numbered several thousands. The young collector will find a very interesting occupation in watching the behavior of one of these groups in its native haunt. A field or opera glass will be of some aid in this kind of study. The eyes of these active little fellows are curious in that each eye is divided into two parts so that there are really two eyes on the upper side of the head which look into the air, and two on the lower side which look into the water. The front legs are much longer than the others and are used for grasping the food. So active are these insects that they are rather hard to collect. Quietly approach one of these groups, very

slowly bring the mouth of the net near them, and then make a very sudden sweep of the surface and there is some chance that some of the specimens will be caught in the net. Keep a number of them in a covered aquarium and feed then on bits of raw meat or small water worms. The slender larvae (Fig. 18) may also be kept in a jar and fed with small water insects.

The Large Giant Water Bug (Fig. 9).

The Large Giant Water Bug is the largest of all the water bugs. It is about 2¾ inches long and about 1¼ inches broad, with a broad flattened body. The second and third pairs of legs are heavy, flattened, and oar-like, while the first pair of legs is held forward in a grasping position. The large wings lie flat on the back when not in use. The large size alone will enable the pupil to recognize this insect. It usually rests or swims about at the bottom of the pond. The eggs are laid in clusters above water on stems of water plants, and these hatch out larvae which are surprisingly larger than the eggs. These larvae pass their entire life in the water, and the same is true of the adult, although it does come out for a short flying season to find its mate or a new pond. At such a time they are often to be found around electric lights at night. They feed on other water insects, young fish, and tadpoles. Collect them at any time during Spring, Summer, or Autumn by sweeping the water plants at the edges of quiet water or ponds. They can often be caught by vigorously hauling ashore the trash which lies under the water near the edge. They can be kept alive in the aquarium for a long time. Keep the aquarium covered since they may fly out at night. Feed them on any of the smaller water insects.

The Small Giant Water Bug (Fig. 10).

This bug, like the Large Giant Water Bug, has a broad flat body with two swimming legs and one pair of grasping legs, well developed wings, and a strong beak. It is much smaller, being a little less than an inch long, and the body is more oval. It often occurs in some abundance in muddy ponds containing an abundance of water plants and in sluggish streams having a muddy bottom. It comes to the surface frequently to get a supply of air. The young collector will probably find specimens carrying a load of eggs on their backs. These are the males on whose backs the eggs have been fastened by the females and the eggs are carried in this way until they hatch. They feed on many other water insects and larvae, such as water boatmen, back-

swimmers, dragon fly and may fly nymphs, and sometimes their own young. They also attack snails and young fish. Collect and fed them in the same way as described for the Large Giant Water Bug. If young ones of different sizes are put into the same aquarium, the smaller ones will be eaten up. It is easy to keep them in an aquarium and to see much of their very interesting life history.

The Predaceous Diving Beetles (Fig. 12).

Both the adult beetles and their larvae can be found at almost any time and in almost any weedy pool of stagnant or standing water. By approaching one of these pools very quietly, these dark, oval, flattened beetles can be seen hanging head down with the tip of the abdomen at the surface of the water. If disturbed,

Adult Insects.—9, Larger Giant Water Bug; 10, Smaller Giant Water Bug; 11, Water Scavenger Beetle; 12, Diving Beetle.

they dive and may conceal themselves at the bottom, but in time they will appear at the surface again. These beetles and their larvae (Fig. 21) are the most blood-thirsty of all the water beetles and are a terror to the smaller water insects as well as to young fish and tadpoles. In fact, the larvae are even more fierce than the adults, and are constantly feeding on almost every living form which they can capture. To collect the larvae or the adults, go very quietly to the edge of some suitable pool and when they come to the surface for air, put the net gently under them when they dive. Since these insects often hide in the partly submerged vegetation near the shore they can be collected by sweeping the

water plants and floating leaves. Handle the larvae carefully as they are easily killed. These insects are easily kept in the aquarium. Do not put larvae and adults into the same jar. Feed the adults on bits of raw meat, larvae, on insects, water worms, or small pond snails. Be careful to keep the aquarium as clean as possible and keep it covered since the adults may fly out at night. Put only one larva in a large jar and feed on the same food as the adult.

The Water Scavenger Beetles (Fig. 11).

At any time from March to November these large, oval, blackish beetles may be found in the same streams and ponds with the Diving Beetles. At first sight they resemble the Diving Beetles, but differ from them in having no yellow on the body, in hanging with the head at the surface of the water instead of the tip of the abdomen, and in moving the swimming legs alternately instead of at the same time. They feed largely on plants and decaying matter. These insects often leave the water and fly about at night. They are attracted to light and the street lights are often visited by them. The eggs are laid in a sort of silken bag which has a stalk at one end. This bag is usually attached to some floating leaf or stem. The larvae (Fig. 22) are somewhat like those of the Diving Beetles in appearance as well as in food habit, since these larvae feed on the smaller animals of the pond. They pass the pupa stage in a sort of cell in the ground outside of the water. To collect these insects, use the same methods as are suggested for the Diving Beetles. For the full-grown insects the aquarium must contain water plants. Feed the larvae with smaller water insects.

The Backswimmer (Fig. 15).

Another form which appears early in the Spring is the Backswimmer, and one may expect to find it in any pool or stream which contains vegetation. It can be recognized in the water by the fact that it always swims upside down. The back is shaped like the bottom of a boat and the flattened hind legs, which are much longer than the others, act as oars. The colors are usually black and creamy white. It will be noticed that the Backswimmer comes to the surface frequently. But why? This insect has to breathe the free air and therefore it must come to the surface occasionally for a fresh supply. As it swims down from the surface the back part of the body has a silvery appearance which is caused by the air clinging to the body and under the wings, being held there by fine hairs. This is the supply of air which the

insect takes under water with it and enables it to stay under water some time. It can leave the water and take to flight and is often found around lights at night. The eggs, which are laid in or on the submerged stems of water plants, hatch into little Back-swimmers which are very much like the adults. Most Back-swimmers feed on other water insects. To collect them, sweep the vegetation growing in the edge of the water, all submerged masses of tangled roots, around submerged logs, and in the water under overhanging banks. Carry them home in a tin box containing some wet water plants if the specimens are to be kept alive; if not, kill them in a cyanide bottle. It is an easy matter to keep them in an aquarium. Feed by dropping a few flies each day into the water near them. Handle them carefully since they have strong beaks and can make painful stings.

The Water Scorpion (Fig. 13).

If the young collector has sharp eyes he may find in the quiet parts of streams and ponds, among the water weeds and trash, a long slender insect, dirty brown in color and having two long slender bristle-like breathing organs projecting from the tip of the abdomen. The last two pairs of legs are long and used in walking, while the front ones are used for the getting of food. It may be seen clinging to some submerged stem with the two long breathing organs reaching to the surface of the water. This is the way it gets its air. The eggs are white oval objects with two threads fastened to one end and are laid in the decaying stems of water plants a few inches under water. The nymphs which hatch from these are small but much like the parents except that the breathing organs on the end of the abdomen are shorter. They feed on water insects of many kinds, small fish, and even on one another. Collect them by moving the dip net strongly back and forth among the water plants. Carry them home in a tin box containing a little wet water weed. Feed them in the aquarium by putting living flies under the water near them.

The Waterboatmen (Fig. 14).

These insects appear in Spring soon after the ice melts on streams and ponds. They may be found in running streams or in quiet pools which contain water plants. They resemble the back-swimmers in shape, but swim with the back up. All are small, none being over $\frac{1}{2}$ inch long. They are oval, dark colored, and have long, flattened hind legs which are used as oars in swimming. They also come to the surface for air, carrying a supply below with them, and are attracted to lights. They feed on smaller water

animals and they are in turn often eaten by sunfishes and minnows. To collect them, sweep with the net the open water as well as the water plants growing near the shore. These are interesting fellows for the aquarium and are easy to keep. Bring them home and feed in the same way as recommended for the Backswimmer.

The Dragon Fly Nymphs (Fig. 4).

These queer, sluggish, mud-colored fellows can be found at almost any time during the year and in almost any kind of aquatic situation. Some crawl about on the bottom while others burrow

Adult Insects.—13, Water Scorpion; 14, Water Boatman; 15, Backswimmer.

into the bottom. They are interesting in many ways but perhaps the most amazing thing about them is the curious under lip which is folded under the head like an arm, the "hand" covering a part or all of the face. This "hand" which has a pair of strong jaws on the tip, can be quickly thrust forward for some distance in capturing prey. They are fierce creatures and make constant raids on the other water insects, even attacking animals about twice their size. After living for some time on the bottom, these larvae leave the water by crawling up stems or other objects and there the old skin is shed and the full grown insects appear. They

are those splendid, swift flying forms which fly about aquatic places and which the young collector may already know as "snake feeders," "snake doctors," or "devil's darning needles." Some times these dragon flies may be seen to swoop down and strike the surface of the water a number of times with the tip of the abdomen. These are females laying eggs.

The nymphs which crawl on the bottom can be collected by rapid sweepings of the dip net on the bottom. Those which burrow into the bottom can be taken by scraping the surface layer of the bottom into the net and then washing out the mud or sand, thus leaving only the nymphs and the coarser rubbish. The garden rake can also be successfully used. The nymphs are easily kept in the aquarium if they are given plenty of clean water and something to crawl out upon. A tub or pail containing two inches of sand and gravel and covered with netting makes a good aquarium. Feed them by throwing in flies or water insects. Small bits of raw meat can be used but they must be moved about so as to appear alive, or otherwise they will not be touched. These insects can be raised easily in the out-door cage.

Mosquito Larvae and Pupae (Figs. 2 and 3).

The eggs, larvae and pupae of the mosquito are to be found during the summer in almost every stagnant pool. The eggs are sometimes laid in little one layered rafts which float about on the surface of the water. The larva or Wriggler which hatches from each egg has a rather large thorax, and a long slender abdomen which is forked at the end. Numerous clusters of hairs occur on the surface of the body. This Wriggler is compelled to come to the surface of the water to breathe, and secures the necessary air by pushing one of the prongs of the forked abdomen through the surface film. After a time the larva changes to a pupa, a curious creature which appears to be all head, with a slender abdomen bent around towards the "face." At the tip of the head (really the head and the thorax united) is a pair of little "ears" which are the breathing organs. When breathing, the pupa hangs by the head at the surface of the water with these little "ears" pushed through the film. Later this pupa changes into the two winged insect, the Mosquito, which is so familiar that no description is necessary. Perhaps none of the other insects can be reared with so little trouble. The eggs or the wrigglers can be collected and placed in a jar of stagnant water containing a little decaying vegetation and they will take care of themselves. It is an easy

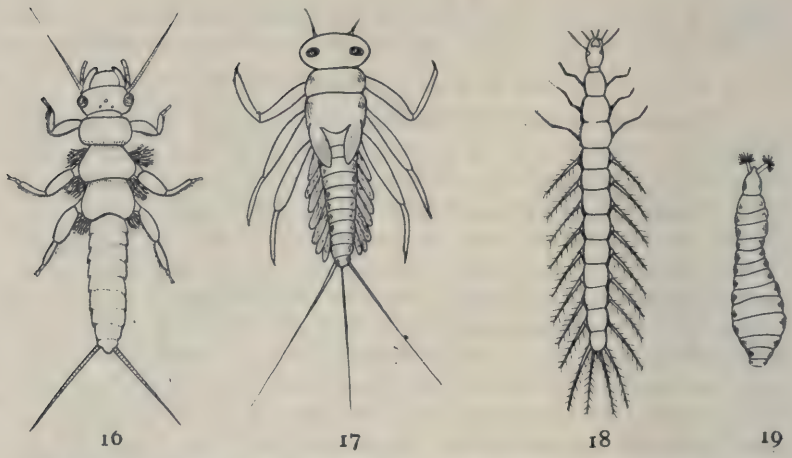
matter to watch the development of the different stages in the life of this insect and to become familiar with the habits of each.

The Stone Fly Nymphs (Fig. 16).

The larval form of this insect is found only in rapid streams, being most abundant in rapids and riffles where the water rushes over half submerged rocks. They may be found at almost any time during the collecting season. Lift submerged stones suddenly and look carefully on the lower side. There will often be found clinging to the rock a flat larva, near ¾ inch long, with two long bristle-like antennae, two long bristle-like structures at the end of the abdomen, and with tufts of branching gills at the bases of the legs. The legs are usually fringed with hairs. They are very active and quickly hide themselves when disturbed. To collect them, lift up stones in rapids and turn over quickly and then pick off the nymphs or wash them off into a jar. They cannot live except in running water, and in order to rear them, push one of the out door cages down over the rock under which some of these nymphs are living—and then watch results. The full grown insect is ½ to 2 inches in length, often grayish in color, has four large, many-veined wings of which the hind ones are the larger. When at rest, the fore wings lie flat on the back covering the much-folded hind wings. These adults can be found near the rocky streams where their larvae live, resting on rocks, roots, trunks of trees and the green foliage.

May Fly Nymphs (Fig. 17).

These nymphs can usually be found in abundance in every sort of fresh water situation and at almost any time during the Spring and Summer. They crawl about on the bottom among the submerged trash or cling to the submerged parts of water plants. The full grown insects are those feeble, frail-bodied, gauzy-winged creatures with long bristles at the tip of the abdomen which often suddenly appear near the shores in such countless numbers and then as suddenly disappear. This appearance usually occurs at the beginning of twilight, and their flying whirling dance is an interesting sight. The mating takes place during this dance and the eggs are dropped to the surface of the water soon after. The adults take no food and usually live but a few hours. They are attracted to light and millions of the dead ones may sometimes be found under a single arc light of a river or lake town. Collect the nymphs by sweeping the bottom and the water plants. Put them into a small aquarium containing a little mud and feed them on water fleas or small water insects.



IMMATURE INSECTS.—16, STONE FLY NYMPH; 17, MAYFLY NYMPH; 18, WHIRLIGIG BEETLE LARVA; 19, BLACK FLY LARVA.

BLACK FLY LARVAE (Fig. 19).

When looking for stone fly nymphs in rocky, swift running streams, the collector sometimes finds clusters of queer little creatures, black in color, and squirming in movements, and attached to the rocks or other smooth objects by the hind part of the body. The free end hangs out into the current and has two brushes of hairs which takes the food from the water. These larvae pass through a pupa stage and then hatch out into those little black, hump backed flies, Black Flies or Buffalo Gnats, which are sometimes so extremely troublesome in the vicinity of their breeding places.

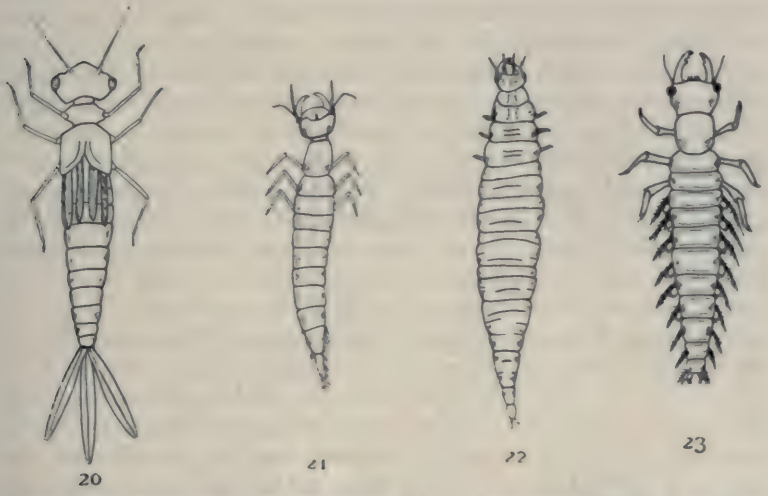
DAMSEL FLY NYMPHS (Fig. 20).

These nymphs are usually abundant in shallow pools, marshes, and in the edges of streams and ponds where water plants are numerous. They crawl about among the submerged plant stems and feed on the small water insects which come within their reach. After living in this way for a time they crawl out of the water on some stem and there change into the Damsel Flies, insects which look like small Dragon Flies but which differ in having the front and hind wings alike and when the insect is at rest they are kept elevated over the back. They are not strong fliers but have a slow, weak, fluttering flight. To collect and

rear the nymphs, use the methods described for Dragon Fly Nymphs.

Dobson Fly Larvae (Fig. 23).

Dip net sweepings among the rocks in streams sometimes brings up a creature which at first sight looks like the Water Tiger, but which has tapering projections along the sides of the abdomen. The head bears a pair of strong jaws and on the thorax are three pairs of legs. It feeds on other water insects. The full grown insect, the Dobson Fly, is that large net-winged insect with long antennae and bulging eyes which is so often killed around electric lights at night.



Immature Insects.—20, Damsel Fly Nymphs; 21, Water Tiger (Larva of the Diving Beetle); 22, Water Scavenger Beetle Larva; 23, Dobson Fly Larva.

Crane Fly Larvae (Fig. 24).

These footless, worm-like, dirty brown larvae are often found in the moss, slime, or decaying leaves on the wet banks of streams very near the edge of the water. They may also be found in the wet rotten parts of partly submerged logs. The head is small and inconspicuous, while the tip of the abdomen usually bears several fleshy projections surrounding two large dark circular breathing pores. The pupa differs from the larva in having a distinct head on the tip of which are two long breathing tubes. These creatures are the immature stages of the Crane Flies, those

long-legged, two-winged insects which fly about in damp shady places and which look like huge mosquitoes. The larvae feed on decaying vegetation and they can be kept in an aquarium which contains wet moss, slime, or damp decaying leaves.

Caddice Fly Larvae (Fig. 23).

Sweepings of the dip net in any kind of aquatic situation is pretty sure to bring up some curious bits of wood or stone which may at first escape the eye of the young collector and be cast aside with the rubbish. Possibly they may be first discovered on the bottom of some clear pool in which the youth will be startled to see some little masses of stones and sticks which look like the other objects on the bottom but which *move*. These are the cases or houses of the caddice fly larvae (sometimes called caddice worms) and a little further search about the collecting grounds will reveal a surprising variety in the way in which these cases are built. Some are made of small pebbles and sand; some are made of little sticks crossed up in such a way as to make a tiny log cabin affair; some are made of sticks placed lengthwise; some are made of bits of leaves and grass, and so on. Although very rough on the outside, the cavity on the inside is lined with smooth silk. The dark headed larva lives in this cavity and carries the case about with it as it moves from place to place, by thrusting the head and legs out through the opening of the case. There are a pair of hooks on the end of the abdomen which help to hold the case in place. These creatures feed on aquatic plants. After a certain period of growth the larva fastens the case to some object, closes the opening at each end of the case and changes into a pupa. The pupa finally leaves the case, climbs up out of the water on some stem or other object, and there hatches into an adult which is a brown or grayish, moth-like insect with long thread-like antennae and long rather narrow wings which have very fine hairs scattered over the surface. These adults can be collected around lights at night. Those larvae which live in

24 25 26

Immature Insects: 24, Crane Fly Larva; 25, Caddice Fly Larva; 26, Blood Worm (Chironomous Larva).

stagnant water can easily be kept in aquaria which contain water plants. Here again the out door cage can be used to good advantage.

THE BLOOD WORM [CHIRONOMOUS LARVA (Fig. 26.)].

In dip-net sweepings of the bottom of weedy ponds or other bodies of quiet water some blood red, worm-like creatures will often be found wriggling in the slime and among the decaying leaves in the bottom of the net. Each has a long slender jointed body with a pair of legs on the first joint and a pair on the last joint. The second from the last joint usually bears two pairs of breathing organs on the lower side. These larvae move about by an irregular looping of the body from one side to the other. They live in a sort of tube made of rubbish. They can easily be reared by placing them in a small glass jar which contains some dead leaves and rubbish on which they feed. They will rebuild their tubes and after a time change into the pupa stage which is very much like the pupa stage of the mosquito except that it has branching gills on the top of the thorax. The pupa finally becomes the adult which is called the Midge and which is very much like a mosquito in appearance.

[TO BE CONCLUDED.]

Some Ideas on Teaching a Bird Course

R. M. STRONG.

Courses in bird study are given now in a large number of schools, colleges, and universities; but, so far as the writer knows, little or nothing has been done in the way of assembling the ideas of various teachers as to how a bird course should be conducted. As the writer is much interested in the methods which are employed by others in bird study, he has assumed that an account of the course which he gives at the University of Chicago may be of interest.

Any course of study may be interesting or dull, intellectually profitable or the contrary according to the ability of the instructor as a teacher; but it is probably agreed that different subjects vary in their inherent attractiveness and educational value. This variation may exist independently of the interest, age, or condition in life of the student. It is the writer's opinion that a bird course may be one of the strongest courses both in discipline and in the usefulness of the information obtained which may be offered by school, college, or university.

Nature Study readers will not need information concerning the value of the knowledge which may be obtained in a bird course, and most cultured people seem to realize more or less fully the importance of a knowledge of birds in enlarging powers of appreciation. The student of birds has no trouble in making his walks interesting if parks or country are available, and a parent who knows something of ornithology has an invaluable mine of material for the development of a wholesome interest in his child's mind. Some ideas as to how a bird course may yield intellectual discipline as well as pleasure will follow.

Much depends of course, upon the careful selection of material. In the writer's experience, most students who elect a bird course desire especially to be able to identify birds, and a large share of the work may be devoted profitably to furnishing what is wished. Few students think very much in advance about the importance of knowing something about the structure and physiology of the bird, yet it seems probable that these subjects should not be ignored in any bird course. Without them a course fails to realize a splendid opportunity to impart excellent biological material, and it must be somewhat narrow in its viewpoint. Moreover students are not slow in realizing the importance of what may be called the "biological" portion of the work.

Above all things, the course should be adapted to local needs and possibilities. What may do well in one institution may go poorly in another. Work given in the summer may need to be different from that of the spring. There should be no obstinate clinging to notions and schemes of uncertain success when better ones can be found. A very large amount of study may be given profitably to the consideration of numerous more or less small details which bear upon the pleasure as well as upon the effectiveness of the work.

The course in bird study conducted by the writer is called a major. It is given during a term of about eleven weeks, and a student may regularly carry three majors during this time. The class is given a certain amount of required work as follows. This spring there are three lecture periods at 7:30 A. M., and two field trips from 7:40 to 9:10 A. M. In the laboratory, at least one hundred and fifty bird specimens must be identified. These are studied in an order which aims to secure their identification before the species arrives. These specimens are not duplicates. No colored pictures are permitted in the laboratory. No definite laboratory hours are scheduled, as little direction is required. The completion of one-half of the identifications is required in the first four

weeks, and the other half must be done by the end of the sixth week. At the end of each of these periods the identification lists which have been prepared are collected and graded. These are returned for corrections, and a few days later oral examinations on ability to recognize the specimens at sight are conducted. The course began April 1st.

Every teacher who permits the handling of the bird skins by a large class has a serious problem in keeping a collection intact for any length of time. The specimens which are supplied at The University of Chicago, as is done at some other places, have been mounted with all parts that may be easily broken off wired to a body and to a wire which projects from the vent. A wooden handle receives this end of the wire. Even with all of this bracing and with abundant admonishings to exercise care, some rough or careless students will cause a great deal of damage. Consequently in order to save some of this wear and tear where it is most likely to occur, a tag which bears wing and tail measurements is attached to the handles of small birds. Other data such as the color of the axillar feathers are added in special cases.

At the Friday morning meeting of the class, a lantern-slide test of ability to recognize birds at sight is being employed this spring for the first time. About twenty species which the class is likely to see in the field are assigned for each of the first six weeks. When males and females differ significantly they are specified. Immature plumages which may be seen by the class are also noted. A slide is provided for each plumage which a bird may show and it has been colored carefully to suggest as much as possible the appearance of the bird in the field. Important characters are often emphasized in the coloring. Small birds are reduced on the slide about three and one-half diameters. Those larger than a robin appear on the scale of one to eight. Museum specimens were used in making the slides. On each slide, a line appears which was six inches long in the plane of the bird when photographed. This serves as a guide in estimating size. Thus, when the reduction is eight diameters the line is three-fourths of an inch long on the slide.

In the test, the student is allowed about one to two minutes in which to write the name of the bird and the characters which were used in the identification. Opposite the name is placed a number which appears on the screen. This number is pasted in silhouette on the front of the slide. Wilson's gummed figures in black, smallest size, are used. They may be bought of the Dennison Manufacturing Company. At the end of the test, the same series of

slides is repeated, and the birds are named by the instructor with their salient characters. This phase of the work is most helpful in preparing students for recognizing birds in the field, and it develops analytical ability.

Bird work at The University of Chicago is favored greatly by the proximity of parks where many species of birds are to be found during the migrations. It is possible to study about one hundred species during a single spring, in Jackson Park less than a mile distant. Land birds sometimes fairly swarm there, and a surprisingly large number of water birds occur on the lagoons. Outside of the city there are excellent places for bird study. Other large cities also have advantages for bird work, fortunately, and a country location is not necessary.

The required field work for the writer's classes is done during the spring in Jackson Park. When a summer course is given, birds must be sought outside the city. City parks furnish a great variety of birds only during the migrations. The field periods begin sharply at 7:40, and they end at 9:10 in order to give time for a return to a 9:30 class. Plenty of birds are found during this period without the strain that hours before breakfast involve for many people. It is the writer's opinion that very early rising for bird work is often overdone with classes, and it is certainly not advisable if the work can be done as well at a later hour. When birds are studied and not simply glanced at, Jackson Park furnishes material enough to make a very full period at any time of the morning during the spring migrations. After several years' trial of a period from 6:00 to 7:30, a change was made to the later period. This shift made the course much more popular, and birds were seen fully as frequently and as well, as before. There was not even a loss in the number of species or of unusual forms.

The class is divided into sections of ten each, and the instructors in charge of each section have definite circuits to avoid the occurrence of many people in one place. The sections are shifted each morning so that each student has an equal number of field trips with the instructor and his assistants during the course. It is made clear that the scheduled field periods are serious class exercises and not picnics, a result which is not hard to obtain when the instructor is business-like and provides a well ordered program.

Much care has been given to the selection of territory for field trips. Only the best places to see birds and the best dates are worth considering at all, if a large class of young people are to be kept thoroughly interested. The average student can not be ex-

pected to have the zeal and patience of the confirmed naturalist, consequently things will drag if birds occur only at very infrequent intervals.

On account of local considerations, trips to the country are not being required this spring, but a few Saturday forenoon trips in May are recommended. These have been variously required in past years. They have been cut down from all-day trips because (1) afternoon conditions are not usually so favorable for observing birds, and (2) many students are usually too tired to do effective work after a long forenoon of earnest work. Too many instructors are inconsiderate of the strength of their pupils and delicate women are expected to undertake tramps which would tire a strong man. The writer believes in the advisability of recommending to the stronger members of the class only, the more strenuous trips which should then be strictly optional.

The most successful excursion of the course is made in June to a lake about fifty miles from Chicago where nesting marsh birds can be studied to advantage. More marsh birds can be found just outside the city, but boats and other conditions are not present for handling a large party. The trip to the lake is made the preceding evening, and work is started very early the next morning. Some marshes in this lake are visited in boats, and nests which have been located a few days previously are examined. As the nests are usually where a boat cannot be rowed or poled, a bridge of boats is made from open water to each nest. Men in the party who are willing to wade, drag the boats one at a time with their passengers in them into a line so that students who

BIRD CLASS IN MARSH STUDYING NESTS.

cannot wade are able to walk from one boat to another to a nest and back again. By this system, nests of the American and Least Bitterns, the Black Tern, the Coot, Florida Gallinule, Yellow-headed Blackbird, and Long-billed Marsh Wren have been visited by a party of forty-five in a single forenoon. Other interesting birds and their nests are observed on this trip.

Success in field work requires that answers to numerous questions be made. As beginners will usually think of very few questions for themselves a carefully planned scheme is desirable. This involves a consideration of every conceivable character or condition of the bird which may be of practical value in identification as well as in general natural history or ecological correlations. This scheme is stated on a mimeographed sheet which the student is asked to place in his field note book. Though the student is supposed to show initiative in using this outline, it has been found necessary in practice for the section leader to suggest the points in the outline which are especially applicable or workable in viewing each bird. Thus he knows that acceleration or accent in song may be characteristic of a certain species, and when this bird is first heard singing, questions are proposed to the section which will bring out observations of this sort. The walking habit of another bird, white wing bars, a long neck, etc., are emphasized in the same way. Not only the more striking characteristics but many points of comparison are considered if the bird stays in view long enough. As a rule, of course, the first acquaintance is a short one and observations of the species are made at other times as opportunities are offered. These notes are placed on catalog cards, a card being used for each species, and the cards are examined occasionally by the instructor who suggests corrections or improvements.

The field notes are also examined and discussed during the last ten minutes of the field-trip on which they are made.

The temptation is strong, when birds are numerous, to cut short the study of one bird to look at another bird that may have come into view. It has been the writer's experience, however, that the final results of the course are much better when this impulse is resisted, unless the new arrival is of very unusual occurrence. There should be patient study of each bird so long as it remains in an observable position, until a good set of observations is made. The outline employed in the field is as follows:

DIRECTIONS FOR FIELD WORK WITH BIRDS.

1. Diagnosis of Characters. This work requires patience but is indispensable to sound work in the course. Take plenty of time to make

thorough and accurate notes. These are to be placed in a small note book which should be suspended from the clothing, or by a string hung round the neck. Fasten this sheet in your field record book. The field notes should be transferred to catalog cards which should bear the name of the bird in the upper left hand corner. The cards may be arranged alphabetically according to birds. Make complete records so far as possible for every species, on the first trip. On subsequent trips, repeat records where previously made records are defective or where there may be need of repetition. Thus, bird songs may warrant several attempts at description. The following general scheme should be used:

Size: Compare with some well known bird like the robin, dove, or the English Sparrow; or give estimated dimensions if practicable.

Form: Note whether the bird is slender or compact. Compare lengths of tail and wings. Note shape of bill and mention any other features, like the lengths of the legs and neck when these are long.

Color: Note distinctive colors and general color effect at a distance.

Flight: Observe peculiarities in manner of flight, such as rapidity of wing motion, undulations in flight course as in sparrows; soaring of some birds.

Swimming: Note diving ability. Does bird seem to be simply resting on water or feeding?

Voice: Quality, pitch, loudness, and resemblance to any other well known sounds. *Duration:* Note whether a song, a cry, chirp, scream, or chatter. If a song, indicate whether a warble, whistle, trill or otherwise.

Locality: Note whether on ground or in a tree, or flying. Mention any other significant points connected with location.

Birds may be classified according to their breeding habitats as follows: (1) Water birds—found about large bodies of water. (2) Shore birds—characteristically seen on shores of streams, ponds, lakes, etc. (3) Marsh birds—in marshes or in low wet meadows. (4) Land birds. Land birds may be further classified according to habit or location of nest as either:

(a) Usually on the ground.
(b) In low trees, in bushes, or in thickets.
(c) In high trees.

Classify each bird according to the above scheme.

If the nest is seen, the following should also be noted: (1) Location. (If above ground, how high and on or in what?) (2) Size. (3) Form. (4) Composition.

Description of eggs, if any occur: (1) Number. (2) Color. (3) Any other points of interest. If young are found, note their number and plumage.

Though students are kept busy during scheduled periods for work, the picnic spirit is encouraged when the class is together but not on duty. Luncheon arrangements, for instance, are organized carefully and other details that may give pleasure are considered. Every effort is made to carry out a program without delays or breaks.

After the first six weeks when the lantern-slide tests are ended, the Friday lecture period will be used for lantern-slide lectures when slides which illustrate nesting habits, behavior, etc., will be used. The other two lectures of each week are devoted to discussions of bird structure, physiology, etc. At the end of the course, each student presents a short paper in which a bird is considered from the standpoint of distribution, classification,

structure, habits, etc. This paper is designed especially to give the student some acquaintance with reference books and other sources of information. Two written tests and a final examination are given for the "biological" portion of the course.

Hull Zoölogical Laboratory, The University of Chicago.
April 15, 1912.

The Study of Birds With the Camera

R. W. Hegner.

[CONTINUED FROM APRIL NUMBER.]

4. CHANGING THE NEST-SITE.

It is rather the rule than the exception to discover nests which are practically beyond the reach of the photographer, being built far out near the end of a branch or high up in a tree that offers no adequate support for either a person's weight or for a camera. The best plan is to leave such nests alone and find a more favorable subject, but sometimes it is desirable to obtain pictures of an inaccessible nest and it is then necessary to change the nest-site. This has been done in many cases with remarkable success. The branch bearing the nest is cut off carefully and moved out into the open where the light is good. After fastening it to a stake firmly planted in the ground, a white background consisting of cheesecloth stretched across a frame may be supplied, and photographs may then be secured as easily as if the nest had been built originally near the ground—*provided the parent birds return to their home.* Many birds desert their nests and eggs upon slight provocation but will usually return to their *young* even though the conditions of existence are greatly changed (see for example the Bluebird picture in the April number of the Nature Study Review). It is therefore best to wait until the young are fairly well grown before making an attempt to move the nest.

The Downy Woodpecker has been selected to illustrate a successful change of a nest-site. The parent birds dug their nest-hole in a slender, half-dead poplar tree about twenty feet from the ground. The nest could not be reached in any way, so the tree was sawed off above the ground and again five feet below the nest-hole. The part containing the nest was then tied to the stump, thus bringing the entrance to the nest-hole about five feet from the ground.

FIG. 4.—DOWNY WOODPECKER WITH FOOD FOR YOUNG.

Birds generally approach their nests in a certain definite way, and these Downy Woodpeckers were no exception to the rule. They soon came back to the neighborhood with food, and flew out from a nearby tree to where the nest used to be. Not finding anything there upon which to gain a foot-hold, they fluttered about a few moments and then flew back to their starting point. This was done several times until finally the young in the nest-hole became so hungry and cried so loudly and persistently for food, that the father bird, who, as in the case of the Bluebird, was the braver parent, finally gave heed and flew down to the nest-site (Fig. 4), delivered his load of food, and cleaned out the nest. After a few trips, new habits were formed and feeding went on with its normal regularity. These Downies became quite tame after a few days and went on with their domestic

duties regardless of my proximity. They even allowed me to saw out a piece of the tree so as to expose the young. All of the youngsters grew up normally and are probably now raising broods of their own.

5. PHOTOGRAPHING BIRDS BY REFLECTED LIGHT.

Nests are frequently hidden away in some crevice, within a building, or beneath a porch or the eaves of a shed so that, under normal conditions, snapshots, which of course are necessary for such rapidly moving creatures as birds, are impossible. Lack of light can, in most cases, be overcome by means of a reflection from a mirror; in exceptional cases two or three mirrors may be necessary.

The nest of the Phoebe shown in Fig. 5 was photographed by reflected light. It was built on a board beneath the eaves of a building, and was not only situated in a dark place, but was in such a position as to make it impossible to take a photograph by placing the camera above it. A mirror was therefore fastened above the nest at an angle, and light was cast upon it with another mirror. By this means a photograph was obtained which

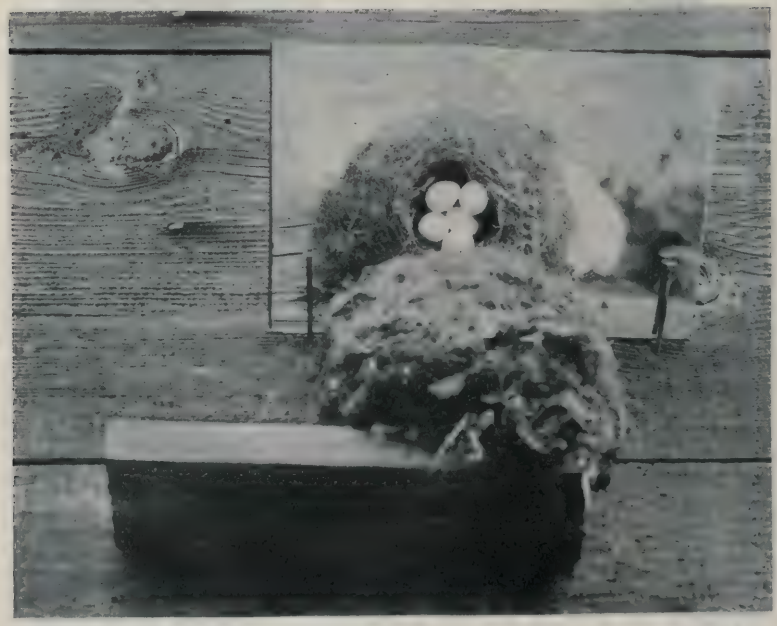


FIG. 5.—PHOEBE'S NEST PHOTOGRAPHED BY AID OF A MIRROR.

contained not only the outside of the nest. but also a reflection of the inside.

The reflection of light with mirrors has also been used successfully in photographing Chimney Swifts' nests twenty feet down in dark chimneys; Barn Swallows' nests fastened to the rafters inside of buildings; Cliff Swallows' nests fastened beneath the eaves of a barn; Bluebirds' nests within holes in trees; Water Thrushes' nests in dark crevices in the banks of streams; and many others.

6. PHOTOGRAPHING BIRDS BY FLASHLIGHT.

The photograph shown in Fig. 6 is that of a female Prairie Horned Lark siting on her nest with feathers ruffled up to shield the young from the chilly night air. It is a flashlight photograph and was taken about nine o'clock at night. The effort to obtain this night picture was made in order to learn whether the mother or father brooded the young at night and if the other parent remained near the nest. The result proved that the mother bird takes care of the children and that the father bird spends his evenings out. This pair of birds were accustomed to seeing a camera near their nest and so settled down for the night as usual. A flashlamp was placed near the nest beside the camera and arranged so that a flash could be obtained by pulling a string.

FIG. 6.—FLASHLIGHT PHOTOGRAPH OF HORNED LARK.

Fig. 7.—Autophotograph of Red Tailed Hawk.

Everything was in order by eight o'clock. An hour later the shutter of the camera was opened by a pull on one string and immediately afterward a pull on the other string resulted in the flash required for taking the picture. The mother bird seems wide awake and is evidently a careful guardian of her offspring, but the father bird is nowhere to be seen.

7. AUTOPHOTOGRAPHY.

The above term is used to indicate that the subject photographs itself. Those who have owned cameras for some time realize that they possess photographs of all their friends but

very few, if any, of themselves. The discovery of this fact many years ago led me to invent the string method of taking pictures so that I might also appear in groups with my friends. This method was found to be applicable to the Red-tailed Hawk shown in Fig. 7, and probably could be employed for many other large birds.

The nest shown in the picture was forty feet from the ground in a birch tree. Nearby was another birch tree which afforded a good place for fastening the camera on a level with the nest and about six feet away. A box the size of the camera was placed in this tree a few days before the photograph was taken to accustom the birds to the presence of such an object. Then one bright sunny day a camera was substituted for the box. A string was passed from the shutter of the camera to the nest, and was carefully stretched across the nest through screweyes (one of which can be seen in the picture) so that when the bird returned it would pull down the shutter release by sitting on the string. Fig. 7 shows the hawk in the act of taking its own picture in this way.

In conclusion I may say that there are few joys that equal those experienced when good negatives are obtained of specially difficult subjects. The problems briefly discussed in this paper are but a few of those that are encountered almost every day by a bird photographer, but they indicate sufficiently well the sort of difficulties and some of the methods of overcoming them.

University of Michigan.

News and Notes

The New York Section of the American Nature Study Society held its annual meeting at the American Museum of Natural History, November 24, 1911. The topic for the evening was *Excursions.* Miss Jean Broadhurst, of Department of Biology, Teachers' College; Miss Ellen Eddy Shaw of the Ethical Culture School; and Miss Pritchett of the New York Training School for Teachers, described trips taken with their classes. Mr. H. G. Parsons, of School Farm League, told of visits to gardens made by classes from public schools.

Another meeting was held Saturday morning, March 3, 1912, at Teachers' College, with the following program:

Subject—*Civic Nature Study.*

Young Citizens as Tree Protectors, Agnes V. Luther, Director of Science, Newark Training School for teachers.

Practical Bird Protection as Established by Baron von Berlepach in Thuringia, Miss Julia E. Rogers.

The officers of the New York Section for the current year are:

Chairman—Miss Anna M. Clark, Head of Department of Nature Study and Geography, New York Training School for Teachers.

Secretary-Treasurer—Miss Helen F. Tredick, Department of Biology, Erasmus Hall High School, Brooklyn.

Other members of the executive committee are: Mr. C. H. Robinson, Montclair Normal School; Miss Margaret Knox, Principal P. S. 15, New York City; Mrs. Anna M. Hill, P. S. 30, Bronx.

Dr. Straubenmuller, Associate Superintendent of Schools, New York City, has been elected Director to the Council of the A. N. S. S.

April 10th, 1912.

On March 20th, the Chicago Nature-Study Club had its annual Good Fellowship Luncheon in the Ivy Room at Mandel's. Nearly 100 were present and enjoyed both the luncheon and the after-dinner addresses. The speakers were as follows:

Walter D. Moody, Managing Director of the City Plan (City Beautiful) Commission.

George E. Brennan, Chairman Principal's Buildings and Grounds Committee.

J. H. Prost, Landscape Gardener for the Board of Education.

Several short speeches followed the above program. Officers were also elected at this meeting. They were, Mr. Grant Smith, President; May R. Spensley, Secretary; and J. W. Shepherd, Director, in the National Society.

Nature Articles in March Magazines.

Craftsman:

Price, O. W.—"Conservation—The Great Principle of National Thrift."

"Planting Large Spaces for Homelike Gardens."

"The Return of the Birds: Feathered Wardens of Our Fields."

Mind and Body:

Moore, H. T.—"Boys Camp of the Playground Association of Philadelphia."

Popular Science Monthly:

Pool, Prof. R. J.—"Glimpses of the Great American Desert."

World's Work:

Oyen, Hy.—"Cleaning Up A State."

"Choosing A Farm." —E. C. Crecelius.

Book Reviews

A Guide to Nature Study. By W. S. Furneaux; F. R. G. S. Longmans, Green and Company, London and New York, 1912. Net $1.35. Cloth. Pp. XV. + 293. Figures 225.

"The purpose of this book is not to supply the teacher with information on all the various aspects of Nature. The aim is rather to lead the teacher to the best methods of treating his subjects, and to supply him with such practical suggestions as will help him in providing and maintaining a suitable supply of material for both occasional and continuous observations."

The body of the book is devoted to a discussion of nature study materials arranged by seasons. The author gives 75 pages to plants and 72 to animals, distributed as follows: spring studies, plants 25, animals 55; summer studies, plants 33, animals 12; autumn studies, plants 10, animals 2; winter studies, plants 7,

animals 3. Just why so much more space is devoted to spring studies than to autumn studies is not clear.

The book is primarily intended for British schools. In order to adapt it to American schools certain modifications should be made.

(1) The inverse order of evolution in classification is not desirable.

(2) Many plants and animals suggested for English studies are not proper nature study material with us. Pages 83 to 85 contain eight figures of fishes, good material no doubt for English schools, but of little value for American children, 45 of the 225 figures are of this character.

(3) Some of the common names such as minnow, dogfish, robin, goosegrass are misleading to American readers. It would make for clearness if, in figures of plants and animals, the Linnaean name were used in addition to the common name.

The chapters dealing with the school museum, the school aquaria, the school vivaria, the rearing of insects, the school garden, and nature lantern slides are very valuable to American teachers.

In general it may be said that the book is a valuable contribution to American nature study as regards method rather than matter.—J. A. D.

The Open Book of Nature: An Introduction to Nature-Study. The Rev. Charles A. Hall. 268 Pages. 115 half-tone illustrations, mostly from photographs, and 16 colored plates. Adam & Charles Black. London.

It is interesting to note the growth of nature-study pure and simple in England; and this growth seems especially fitting in a country which produced Isaac Walton, Gilbert White, and Richard Jeffries. *The Open Book of Nature* is the latest addition to this literature, and it is a most companionable and delightful volume. Its avowed purpose is "to stimulate nature interest in young people and to encourage, wherever practicable, pursuit of natural history." The author declares himself an out and out advocate of work in the field and does not highly value "arm-chair natural history." Especially pleasing and wholesome is the following statement in his preface:

"And one thing I insist upon: No matter how widely a naturalist may travel or how extensive his knowledge may be he ought to know every inch of the ground of his own district.

and be familiar with its flora and fauna. I should like a young people's natural history club formed in every parish of our dear old country. Under wise guidance such clubs might be instrumental in making a thorough nature survey of the whole land—a consummation most devotedly to be wished."

The book begins with practical suggestions about how to begin nature-study. It first takes up the work of running water and a study of the rocks; much space is given to fossils, and many practical suggestions are made as to collecting, preserving and naming them, as well as how to connect them with the living forms of the present day.

The methods suggested for studying plants are interesting and practical; they include observations upon the localities in which the plants grow, their method of growth, their means of fertilization; and a detailed example is given on how to make notes on a plant day after day, illustrated by the colt's-foot. To help in the determination of flowers an illustrated outline of botanical terms is given. Of the most value is this advice: "Make pets of a few plants. I mean exactly what I say—make pets of a few plants, just as you would make pets of rabbits, mice, pigeons, and guinea pigs. You could put your plant pets in pots and keep them in the house for observation; you may grow them in a special corner of your garden; or you can watch them as they grow in their natural haunts." There are a large number of beautiful illustrations of plants from photographs.

Four chapters are given to rambles in springtime, containing plenty of suggestions as to what may be seen together with interesting facts concerning flowers, insects, birds, and mammals. The last chapter gives careful and practical directions for photographing natural objects in the field and under control; and also suggestions for making aquaria and various kinds of breeding cages, and other practical hints.

The Open Book of Nature is not one which we would care to read indoors; every page of it makes us wish to go out and see for ourselves. And since this is the idea which inspired the book, the author is to be congratulated upon his success.—A. B. C.

No better book has appeared in English to serve the student who desires to get up-to-date on the rapidly changing notions of psychology in regard to mind in the lower forms. The value

of the book is enhanced by excellent bibliographies at the close of each chapter. The volume is thoroughly enjoyable and intelligible to the lay reader who is not a trained psychologist.

Rolf in the Woods, by Ernest Thompson Seton, Doubleday Page & Co., pages XV plus 437, $1.75.

This book describes the adventures of a boy scout during the war of 1812. The intention is not so much to impart historical information, although that is accomplished, as it is to familiarize the lad with wood-lore. It seems to the reviewer quite the best book that Thompson Seton has yet written along popular lines. The story is fascinating; the sketches of the life history of animals come in naturally and without that obtrusiveness which is almost necessary when an animal is taken as the hero. No boy can read it without being impelled to the woods and nearby fields to play at scout and watch the wild things of his own locality.

The Land We Live In, The Boy's Book of Conservation, by Overton W. Price, Small, Maynard & Co., Boston, pages 242, $1.50.

This book is illustrated with 136 reproductions of photographs, all of which are excellent, so that it may be read by its pictures almost as well as by the text. The author's intention is indicated in the title of the book. The forests, the farms, the minerals and the rivers are discussed in simple and interesting ways so that boy or girl will read it with pleasure, and the author always has in mind suggestions of ways in which even a child may help in the conservation of the natural resources.

Animal Intelligence by Edward L. Thorndike, pages 297, the McMillan Company, $1.60.

This book reports a series of experiments on cats, dogs, chickens and monkeys conducted by Dr. Thorndike, and discusses the bearing of the results on animal behavior and the evolution of the animal intellect. The opening chapter is on consciousness and behavior, then follows a long chapter, 135 pages, on the experimental study of association processes. Chapter V, 68 pages, is devoted to the mental life of the monkeys. Dr. Thorn-

dike has been prominent in adding to our knowledge of animal psychology and his books are authoritative, clear and interesting. His psychological discussions are free from the technical expressions that rendered much of the older psychology unintelligible to the layman. Every nature teacher dealing with animals should read a book of this sort so as to appreciate the problems and to guard against hasty conclusions and anthropomorphic expressions.

The Evolution of Animal Intelligence, S. J. Holmes, Henry Holt & Company, pages 296, $2.75.

Dr. Holmes in this book gives a very good summary of the work that has been done in recent years on the experimental study of intelligence in animals from the Protozoa up. The headings of the chapters will give an idea of the scope of the work: Chapter I, Introduction; II, Reflex Action; III, The Tropisms; IV, The Behavior of Protozoa; V, Instinct; VI, The Evolution of Instinct; VII, The Non-Intelligent Modifications of Behavior; VIII, Pleasure, Pain, and the Beginnings of Intelligence; IX, Primitive Types of Intelligence in Crustaceans and Molluscs; X, Intelligence in Insects; XI, Intelligence in the Lower Vertebrates; XII, The Intelligence of Mammals; XIII, The Mental Life of Apes and Monkeys.

God's Calendar by Wm. A. Quayle, pages 76 with thirteen full page plates, Jennings and Graham, $1.50.

This charming book is a series of brief essays on the months with an introductory one on God's Calendar. The plates are exquisite; each is appropriate to one of the several months. Anyone who knows Bishop Quayle's diction will anticipate a pleasure in reading this book and he will be in nowise disappointed.

The Career of the Child, Maxmilian P. E. Groszmann, Richard G. Badger, Publisher, Boston, pages 335, price $2.50.

Frederick E. Bolton, State University of Iowa, writing the introduction to this book says, "It would mean much if every teacher from the kindergarten through the university could be well grounded in the fundamental principles of biology, anthropology, psychology and sociology."

The present writer has undertaken to summarize our knowledge along these several lines and indicate the educational bearing. The book contains extensive quotations from writers on these subjects grouped under chapters discussing the school activities. Chapter XI is on nature work as an objective basis and includes pages 170 to 179. This states the results of the familiar studies of Earle Barnes and of Edward R. Shaw, and quotes from a few other writers who have expressed opinions as to subject matter and methods in nature study. It calls attention to the value of first hand experience, but on the whole is too brief to be more than suggestive of what we need to know in order to have any adequate pedagogy of nature-study.

Chemistry, An Elementary Text-Book, by Morgan and Lyman. Pp. XIV+429. The Macmillan Co. $1.25.

In the preface of this book the authors state: "In the preparation of this text the authors have been actuated by the feeling that the student should never be allowed to get the idea that chemistry is a science that dwells inside laboratories and acts chiefly in beakers and test tubes. He should be conscious continually of its presence about him on every hand, in nature, in the home, and in the whirring world of industry. * * * Consequently, the authors have tried to bring out the *humanistic* side of the science, to use as far as possible that material which is laden with intense human interest because of its significance to the race." The advance notices of the book led us to expect a text-book of chemistry that would be of large value as a source book for teachers of nature-study who desired to introduce some elementary chemistry into the grades. In this respect, however, the book is a disappointment. It seems, however, to be a clear, well written text-book of chemistry intended for High Schools, and it has many explanations of common chemical phenomena, as well as attractive illustrations of the same. It is, however, the old type of descriptive chemistry, with these additions in the interest of a comprehension of some of the more common commercial chemical processes. The reviewer has a vivid recollection of an elementary course in chemistry presented from the nature-study point of view, where the object was not so much the accumulation of a mass of chemical information as it was the development of a scientific method of approach. It is to be hoped that a text-book on elementary chemical nature-study may some time

enable the grade teacher to utilize the very interesting material of chemistry for nature work.

Introduction to General Science, by Percy E. Rowell. The Macmillan Co. Page XXIX+302. 75 cents.

This is intended as a text book for a first year course in science, such as is frequently being introduced now in the first year of the high school. There are something over a hundred experiments outlined, ninety-two of which are supposed to be done by the pupil, and these experiments cover a number of subjects, including ordinary combustion, conduction, distillation, center of gravity, the seasons, electroplating, color, atmospheric pressure, the making of a boomerang, the dew-point, osmotic pressure, sedimentation, digestion of proteids, fatigue, etc. It is very evident, therefore, that the range of the book is very wide, and a glance at the page headings makes this even more apparent. The directions for the experiments are brief, concise, and yet as a rule sufficient so that a teacher, though not a specialist, could readily perform them. In most cases no expensive apparatus is needed, although the apparatus suggested is what one would ordinarily find in a laboratory. The teacher, however, who has had the ordinary High School work in science, would find the book of considerable help in the adaptation of our scientific knowledge to some of the simple science of the upper grades. For the High School teacher who wants a first year course the book is an exceedingly suggestive one. There is quite an extensive bibliography to which detailed reference is made throughout the text, and there is appended a list of needed apparatus and materials. Until High School teachers shall come to some agreement as to what should be included in the High School course, the best that can be done is for each teacher to experiment with the materials that in his own opinion are best fitted for the High School work; this book is interesting as an expression of opinion as to the character and extent of the material that should be included in the first year High School science course.

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VOL. 8 SEPTEMBER, 1912 NO. 6

Nature Study and Elementary Agriculture

ANNA BOTSFORD COMSTOCK.

In looking over the literature, including text-books, outlines for study and leaflets on elementary agriculture, we are forced to the conclusion that a comparatively limited amount of subject-matter may be thus taught. The writers of these books and leaflets find themselves restricted to lessons on the care of poultry, the uses and treatment of cattle and other stock, and methods of raising a few of the common field crops. In fact, there is a great difference in the amount of agriculture which may be taught as such, in the elementary schools and that which may be taught in the high schools.

The country teacher finds that when she has had a corn show, a potato show, or perhaps a show of some leading garden crop, she must repeat the same next year, and too often the interest wanes after a year or two of this competition. It is rare indeed when a country school offers exhibits of this kind, for three consecutive years. It is natural for the children to get tired of doing the same thing over and over unless the premiums are so great as to overcome this natural disinclination.

It is with no thought of belittling the work of elementary agriculture that this statement is made. The writer believes that the corn shows and poultry shows and all such work in our country schools is of inestimable service to the pupils and to agriculture. It is, instead, with an intent to strengthen the weakest point in the teaching of elementary agriculture that the following suggestions are given:

If the teacher learns to base her agricultural work upon nature-study she can, to a large extent, overcome the above mentioned difficulty. Thus when the boys are growing corn, she can give them a series of experiments to show the nature of the corn plant; and when they are working out their stock problems, she

can give them some lessons which will help them to a better understanding of domesticated animals, and put the work on a more interesting basis. Then she may lead the pupils to study carefully the little four-legged tenants of the farm to learn whether they are paying rent or not; and encourage likewise a study of the birds and insects to discover what they are actually doing to help or injure the farmer; and if she leads the pupils to examine their fence corners and roadsides to find what the weed squatters are doing, she will find there an almost unlimited amount of subject-matter, all bearing directly upon the farm; and at the same time she will be broadening the interests, knowledge, intelligence and powers of observation of her pupils.

It is safe to assert that there is not on the farm a plant, tree, bird, animal, or insect that is not doing something, in its own small way, to that farm. And, if elementary agriculture be thus correlated with nature-study, the lessons may be of quite as fundamental importance and at the same time of never-failing interest. There is no danger that this use of nature-study will narrow the child's ideas, because it covers such a wide range of subjects that it will result in the young farmer becoming a field naturalist as well as a more practical agriculturist.

Wild Flower Gardening

FRANK C. PELLETT.

As our country grows older, and our resources are developed, there is great danger that many of our finest wild flowers will be exterminated. Wastefulness and abundance go hand in hand. The bison, which was the most abundant of our native quadrupeds, and the wild pigeon, the most plentiful among birds, were almost totally destroyed before the public even realized that the numbers were being dangerously reduced. In the case of the pigeon, the awakening came too late.

The development of the country over large areas of the central west is of such a nature, that no natural refuges are being left for the wild flowers, and unless they are given a place in our private gardens and public parks, they are doomed to follow the pigeon into oblivion. For some time past, the writer has been agitating the importance of saving the desirable native species in this manner. Mr. Clute, of the American Botanist, goes further, and suggests that the railroads be interested in saving the flowers growing along their rights of way. If they can be made to see the advantage of it, it will be an easy matter to make wild flower re-

WILD PHLOX AND VIRGINIA WATERLEAF BLOOMING IN THE WILD GARDEN OF FRANCIS PELLETT, ATLANTIC, IOWA.

fuges many miles in extent along the railroad lines. The original prairie flora of Iowa and Illinois, is, at present, to be found represented in but few places, excepting along the railroads.

School gardens are now being established in many cities, and in these gardens the wild flowers should be established and maintained permanently wherever possible. Those who have private gardens, should also have their attention called to the possibilities thus offered.

The writer has a tract of five acres of native woodland where no animals are allowed to graze. This is kept for a wild flower and bird preserve, where nature has her own way, and the growth is so dense that it is difficult to walk through it at some seasons of the year. Here, only, may some of the less vigorous and showy plants remain. In this section nearly all the land not in actual cultivation is pastured, and the tramping of the animals together with the grazing is rapidly eliminating the flowering plants from the small areas of woodland. In addition I have also about an acre devoted to a wild garden, in which is planted every desirable wildflower that can be found in this section. I have

tramped and tramped in search of species that a few years ago were common, but now are apparently gone from this locality.

Some species should be transplanted only in fall, others are best taken up in spring, while a few can be moved at almost any time. The Columbine is especially easy to transplant, and I have found no difficulty in moving them in early summer. The lilies may live if taken up in spring or early summer, but give unsatisfactory results. They are hard to find when dormant but should only be taken up at that time if possible. I have taken them up at other seasons a number of times only to be disappointed by the failure to bloom for several years thereafter. If they can be located and marked while in bloom they can be transplanted as soon as they begin to die in the fall. All the shrubs such as wild roses, dogwoood, false indigo, and similar plants should be taken up in spring before the leaves start. Wherever fall planting of fruit trees is practiced by orchardists, as is the case in many localities in the eastern and southern states, they will do as well or better if transplanted in the fall. In the prairie regions of the central west spring planting is to be preferred for shrubs as the winters are very severe on newly set plants unless well mulched. They may however, if necesary be moved at any time after the leaves fall and before they start again, when the ground is not frozen.

Many of the smaller spring flowers like bloodroot, wild ginger, violets, buttercups, etc., may be readily transplanted at blooming time, if carefully handled, and the blossoms pinched off, to relieve the plant of the strain of maturing seed, while re-establishing itself.

In making such a garden, the summer and fall flowering plants like starry campion, campanula, white snake root, and astors should not be overlooked. It is quite possible to have a continuous display of wildlings from the time the frost is out in April, until freezing weather in October.

As some species are restricted to a limited range they are much more liable to extermination than those that are common to a large scope of country. Such will have their chances of survival greatly enhanced if nature lovers who have gardens will co-operate by exchanging specimens. Personally I will be glad to send those common to this section, in exchange for wild flowers native to other regions. I find a great difference in the flora of the eastern and western part of Iowa. How much greater the variety when the area of several states is considered.

Atlantic, Iowa.

The Insect Life of Pond and Stream

PAUL S. WELCH.

University of Illinois.

PART III.

HOW THE COMMON AQUATIC INSECTS PASS THE WINTER.

Aquatic insects, as well as terrestrial insects, must have means of providing against the hardships of our winters. There are two factors which are characteristic of this unfavorable season and which threaten the lives of insects unless adequate adjustment is secured. These factors are (1) the low temperature, and (2) the scarcity of food, this factor being largely the result of the first. This means that in order to successfully combat these conditions the insect must have an inactive, resistant, more or less protected stage which normally occurs at this season. This stage may be any one of the four life history stages—egg, larva, pupa, adult. The majority of the common aquatic insects which have been described in these papers pass the winter either as Adults or as Larvae. The following partial list will give some idea of the different hibernating stages:

(1). *Insects Which Pass the Winter as Adults.*—Back-swimmers, Waterboatmen, Smaller Giant Water Bugs, Larger Giant Water Bugs, and the Whirligig Beetles burrow into the mud in the bottom of the streams and ponds. Water Scavenger Beetles and Diving Beetles burrow in the mud of the bottom or in the mud of the banks and sides of the pools. The Marsh Treader hibernates under the rubbish along the banks. The Water Scorpion burrows into the mud of some sheltered bank. Mosquitoes hibernate under boards, trash, and rubbish although it is said that they may also pass the winter as larvae and are sometimes found frozen in the ice but become active when thawed out. The Water Strider passes the winter in the mud, under leaves or rubbish on the banks, or at the bottom of the pools.

(2). *Insects Which Pass the Winter in the Pupal Stage.*—Of the common water insects, only some of the May Flies pass the winter in this stage.

(3). *Insects Which Pass the Winter in the Larval or Nymph Stage.*—Damsel Flies, Dragon Flies, Blood Worms, and Dobson Flies pass the winter in this stage in the bottoms of streams and pools. Some of the May Flies and some of the Stone Flies pass the cold season in the same way. Some of the

Stone Flies emerge in the winter and have been found transforming on the edge of the ice. As stated above, mosquitoes have been found in the larval stage in mid winter.

Winter Collecting.

There seems to be a false impression prevalent among beginners to the effect that no success whatever attends winter collecting, that most insects die off at the coming of winter and what few may live through this season are so thoroughly entrenched in their winter quarters that they are secure from the collector. The above paragraph on the hibernation of the common water insects shows that many pass the winter as adults or as larvae and that their hiding places are not inaccessible. Any youth who knows something about the winter hiding places of water and who has the requisite ambition and energy will usually find his collecting efforts rewarded. Of course, winter collecting is never so easy and pleasant as summer collecting but nevertheless it is possible and can be made profitable. It will require close observation since at this season the insects are more or less torpid and the immovable forms may escape the eye of the collector. The following general instructions may be of service to the beginner who desires to do winter collecting:

(1). Turn over and examine carefully masses of leaves, twigs, roots, drift, and other rubbish which occurs along shores and banks. This kind of collecting can best be carried on when there is no snow on the ground.

(2). With a strong dip net make sweepings along the surface of the bottom. Dragon Fly Larvae are often secured in this way since some of them are frequently found moving sluggishly along the bottom even in mid winter.

(3). Dig into the bottom with the dip net and bring up loads of the mud and debris. Wash out each haul thoroughly by scooping up the clear water with the net and letting it drain through thus facilitating the examination of the catch. After this is done the mass remaining in the net must be examined with considerable care since such forms as the Smaller Giant Water Bug, Larger Giant Water Bug, Whirligig Beetles come up so torpid and with so complete a coating of mud that they are often almost indiscernible.

(4). Dig into the protected banks, near or slightly above the edge of the water and follow the instructions given in (3).

Many of the insects collected in this way are in a very torpid state; others quite sluggish but show some movement when dis-

turbed. None are likely to be found in an active state. Most torpid specimens when brought into a warm temperature liven up and in time become quite active.

Economic Importance of the Common Water Insects.

The fact that aquatic insects are related directly or indirectly to human welfare is usually overlooked or at least underestimated. Aquatic insects may be of economic importance in one or both of two ways: (1) they may be hurtful, or (2) they may be beneficial. A brief statement of a few of the well-established facts will indicate the nature of these effects.

(1). *Detrimental Water Insects.*—It is now definitely known that, aside from the annoyance of its bite, the adult mosquito is of vital importance to man because of the part it plays in the carriage and transmission of Malaria and Yellow Fever. Black Flies torment domestic animals and are a serious annoyance to man. The Larger Giant Water Bugs, the smaller Giant Water Bugs, the Diving Beetles (both larvae and adults), the Water Scorpions, and the Backswimmers are all said to attack young fish and to be a menace to fish culture.

(2). *Beneficial Water Insects.*—The Water Scorpion renders service in preying upon larval Mosquitoes while the adult Dragon Flies are said to make war upon the adult Mosquito. Water insects are of special economic importance in that they constitute such a large percentage of the food of our commercially valuable fishes and are thus one of the important factors in the fish industry.

The Making of a Permanent Collection of Insects.

The writer is one of those who believe that in the making of an insect collection there is much to be gained for the beginner, particularly if the collecting be properly guided and controlled. Two rules may be established for general procedure:

(1). Learn all you can concerning the insect and its activities while it is alive and in its native haunt. When this is completed as far as possible or practicable, then—

(2). Secure a moderate number of specimens for a collection.

In general, it will be desirable to use the following methods for preparing aquatic insects for a collection: (1) Adult insects can be pinned and allowed to dry, or if so desired, can be preserved in alcohol or formalin. (2) Larvae and Nymphs will need to be put into some preserving fluid: pinning is not to be recommended since drying produces distortion.

In pinning specimens, the following directions are suggested:

(1). Use regular insect pins (preferably the Japanned pins) usually of size No. 2 or 3.

(2). If possible pin the insects shortly after killing them.

(3). Pin uniformly so that one-fourth the length of the pin extends above the insect.

(4). Pin Beetles through the right wing cover about one-fourth of the distance back from the base. Pin other water insects through the middle of the thorax.

(5). Put small date and locality labels on the pin of each insect.

(6). Store in a tight box which has the bottom lined with cork or some good substitute.

For preserving Larvae and Nymphs, the following brief general instructions are recommended:

(1). Preserve in 75-85 per cent alcohol or in 4 per cent formalin, in vials of appropriate length and diameter. Alcohol, formalin, and vials can be obtained from any druggist.

(2). A small neat label should be put either on the outside or inside of each vial on which should be written the name of the specimen, date of capture, locality of capture, and a number which refers to the field notes. If the label is to be put inside of the vial be sure that the label is written with pencil on white paper.

Conclusion.

It is scarcely necessary to call attention to the fact that these articles on Pond and Stream Insects have been in no wise exhaustive. In fact they represent only the smallest beginning of the study of this great field of animal life. The insects which have been referrred to are only a few of the common forms selected from the large number of fresh water species because their size, wide distribution, abundance, and ease of observation and collection make them suitable material for the beginner. The diligent youth who finds interest in this work will discover that as his knowledge of aquatic life increases the wider does the remaining field of the unknown become. He will constantly be meeting new forms, new modes of behavior, new activities, all of which are rich in interest but much of which may of necessity remain hidden, at least for a time, and it is well that it is so. The writer agrees with those who hold that it is important that the pupil should be brought to realize to some extent the wide scope of any biological subject which is being studied; that the realization of outlying territory of unexplored matter gives a

sense of incompleteness which tends to support interest, to stimulate and encourage further study, and to give a proper appreciation and evaluation of the subject.

Hygiene as Nature Study

F. M. GREGG.

PART I.

INTRODUCTORY.

The "blessed trinity of chance, accident, and mistake" is apt to be operative in the pioneer days of all great movements. The conviction is now widespread that much of the futility and unpopularity of physiology and hygiene in the grades is due to the unhappily chosen matter and unprofitable manner of presenting the subject to its supposed beneficiaries. The matter has been too technical, and the manner has been too exclusively bookish. There has been lack of proper motivation, the topical selection has been logical rather than psychological, and the appeal has been remote and individual rather than immediate and social.

Many schools and institutions have been struggling for better things, among them the Training School of the Peru, Nebr., State Normal. In this latter institution an effort has been made through the last three years to work out a more satisfactory course in Hygiene (no technical physiology is taught below the eighth grade), with the result that while the course is not yet entirely satisfactory the pupils as a whole in the fifth and sixth grades, in which the greater part of this work has been done, have come to regard hygiene as their most interesting subject.

The general plan for the lessons employed calls for (a) the selection of some nature study topic that allies itself with hygiene, (b) the study of the same in the typical nature-study way, (c) the drawing of conclusions that have a bearing on the subject of hygiene by the pupils, (d) the establishment of such habits by the pupils as properly grow out of the topic treated. It is hoped that the series of articles to appear in the Nature Study Review may help to get the general method before a wider constituency, and may secure from that constituency such criticism as may result in a less imperfect presentation.

Let it be said that this series of articles is written with fourth and fifth grade pupils in mind, subject to wider use with adaptations.

1. Some Studies of Breathing.

(A) The Nature Study Approach.

1. *Apparatus.*—A home-made spirometer can be prepared from a gallon bottle. The bottle can be easily graduated as follows. By calculation, or otherwise determine and mark the level to which an ordinary water glass must be filled to contain ten cubic inches of water. Now, knock the bottom out of the gallon bottle, stopper the mouth, and hold the bottle in a vertical position, bottom upward. With the measure provided, pour ten cubic inches of water into the bottle and with a glass cutter or new three-cornered file make a scratch on the ouside of the bottle at the water level. Pour in another ten cubic inches of water and mark the new level as before, and so proceed till the bottle is completely graduated in ten-cubic-inch intervals. For this study there will also be needed a tub or other large vessel of water and a rubber tube of about a half inch internal diameter and two feet long. The rubber tube should be provided with a short glass tube to fit into one end and serve as a mouth piece for the experiments.

2. *Procedure.*—Children like to "test their lungs." After filling the bottle with water by immersing it in the larger vessel of water, hold it with its open end under the water level and insert the rubber tube in the open end of the bottle. Now let the pupils in turn fill the lungs quite completely while either sitting or standing erect, take the mouth piece of the rubber tube between the lips, and exhale all the breath they can from the lungs, delivering it into the bottle. Just before the pupil quits exhaling see that the water on the inside of the bottle is level with that on the outside and when the exhalation is complete take the reading of the pupil's vital capacity from the volume marks on the bottle.

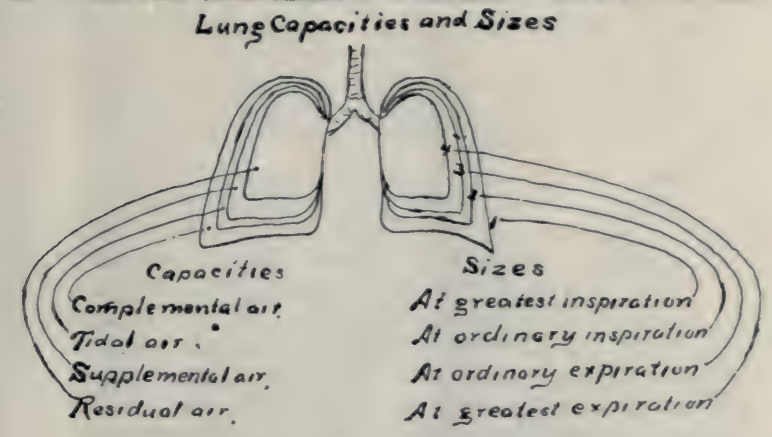
Rinse the glass mouthpiece, after each using, in a glass of fresh water, put a little hydrogen peroxide (which should be in every school room anyway) on the mouthpiece, and rinse again. This procedure is not only hygienic, but it will act suggestively to impress the need of care in such matters.

Repeat the experiments, this time requiring each pupil to sit "on the small of his back" on a chair, as pupils are often inclined to do while studying books. Compare these results with the former results.

With upper grade pupils the following additional sets of measurements can profitably be taken: (1) After *taking in* an ordinary breath, exhale into the bottle all that can possibly be exhaled; (2) after *exhaling* an ordinary breath, again exhale into

the bottle all that can possibly be exhaled. Subtracting the first of these measurements from the original measurement (vital capacity) the pupils complemental capacity is gotten. Subtracting the second of these measurements (supplemental capacity) from the first of these measurements, the pupil's tidal or common breathing capacity is obtained.

The occompanying illustration will help to make all these matters clearer.



A record of each pupils capacities should be posted in an appropriate place.

3. *Suggested Additional Experiments.*

(a). Take a record in seconds of the longest time each pupil can say "ah", using as little force as possible in doing this. Compare these times with corresponding capacities.

(b). Exhale through a glass tube into a glass fruit jar and when the jar has been filled with exhaled air invert it over a short, burning candle. At the same moment invert another similar jar with fresh air over another burning candle. Note the relative time the candles continue to burn.

(c). Get a number of small vials just big enough to hold large-sized locusts (commonly called grasshoppers). Select pairs of locusts of equal size and put each locust in a vial. The vial for one locust of each pair should be filled with exhaled air and then both should be corked and laid aside for a number of hours. Note the relative time when the members of each pair cease to be inactive (quit breathing) and if possible remove each from the vial at that moment and note what happens after a short time.

(d). Let each pupil fill a wide-mouthed bottle with his own breath by breathing into it through a glass tube. Cork the bottles and let stand till the pupils come in fresh from vigorous outdoor play. Now explain that if the breath in the bottle has a bad odor on being smelled it is generally a sign of decayed teeth or something like that. Let the pupils now smell the bottles but do not ask for reports. [The teacher should know that carbon dioxide is practically odorless, and that the bad odors of inhabited rooms come chiefly from unclean skin and clothing.]

(B). Some Hygienic Conclusions.

In the light of the experiments indicated above (and others that may occur to the teacher) and before any book study has been indulged in, consider with the pupils such questions as the following:

Of two boys the same size but of different lung capacities, which do you think could run the longest distance or climb the greater number of stair-steps without running out of wind? Give reasons for sitting erect in one's seat. What do you notice about the chests and shoulders of the finest looking men and women you meet on the street or highway? Do you suppose a boy or girl could get a larger chest if he tried? What do you think one could do to have a larger chest and lungs? Shall we all "test our lungs" again about once a week to see who can make the greatest improvement?

How do we know that the air we breathe out is different from that we take in? Do you think it is poisonous? (Popular

physiology says it is, but let us hope that our teacher here is better informed. Do not let this inquiry lead to discussion of the exact composition of air below the seventh and eighth grades. It is a waste of time and mentally deadening). Can you give any reason why it is not good to breathe air that has been once breathed? If one should breathe only fresh air, can you figure out how much fresh air you would need every hour? (For uppergrade pupils only). If your own breath should smell disagreeable what do you think should be done? Why? (The social reason will be more efficacious than the individual one.)

(C). Some Follow-up Studies.

After the approach to the subject of breathing has been made in this nature-study way, and the pupils have themselves been stimulated to ask questions, then is the time to assign book readings. But this book reading should be extensive rather than intensive. If the pupil has not been motivated by his initial study, little will be gained that is enduring if he is now compelled to be able to recite so much text-book matter. At the end of the study, however, the essential points should be crystallized into definite statements to find their way into the pupils note book on Nature Study and Hygiene.

Some studies of Ventilation may well follow the study of breathing.

Observations on a Pair of Nesting Song Sparrows

RALPH E. WAGER.

Northern Illinois State Normal School.

One of the most important and constant agencies in keeping down the hoards of insects, is the bird. This fact is slowly impressing itself upon us. Remove the bird, and insects, even at the best vexatious enough, multiply prodigeously, since one of their natural enemies is removed from the struggle.

While this relation between birds and insects has long been recognized, yet the time is not past for further studies with reference to it. Facts already at hand have been obtained chiefly by killing large numbers of a given species and examining the stomach contents in order therefrom to identify the insects it had eaten. These studies have been undertaken by state and federal authorities and the results set forth in bulletins published by them. This method of attacking the problem is of course the only

practicable one under ordinary conditions. When, however, birds are rearing their young, their activities are considerably localized, and, by properly accustoming the birds to his presence, one can observe directly what they are feeding to the nestlings; and by patient observation can determine also how often and how much they are feeding. This does not necessitate the destruction of bird life, and has additional advantage, also, in that it retains as an element of interest in the undertaking, the charm of the bird at work, meeting in its way the problems of its existence. Furthermore, actually to see the parent birds bringing to their young large numbers of larvae injurious to various plants, lends to their beneficient work a realism which is otherwise impossible.

It is unnecessary to review the work done on the feeding habits of birds. Bird students are acquainted with the facts. However, there are but few records of the activities of nesting birds extending over any considerable interval. Many observers have recorded such activities as have been carried on for a few hours, *but it is impossible to appreciate the full significance when so little is known. The present paper is an attempt to record, imperfectly it is true, the work done by a pair of song sparrows in one day's time. So far as the writer knows there is no record of similar observations on this species.

On June 4th the writer discovered a nest of a pair of song sparrows so located as to lend itself easily to observation. Several bird-students, chiefly members of a Nature Study class, were enlisted in the undertaking of making the record. The nest was located in a shallow pit along the margin of which was a thicket of hawthorns furnishing a convenient screen. Observations were made from a distance of about fifteen feet.

The nest was discovered in the evening. The following morning a camera was set up near the nest. Later in the forenoon it was moved nearer and focused upon it. As often as possible during the day visits were made to the nest in order to accustom the birds to human presence. In the afternoon it was found that the female was feeding the young regularly, though, at any rate while observed, showing some fear when approaching the nest. She alighted at some little distance from it and approached by skulking through the grass. The male brought food, but could not overcome his fear of the strange objects. He, too, approached by skulking through the grass along the margin of the pit, until

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*For an excellent bibliography see Weed & Dearborn's "Birds in Relation to Man." Published by Lippincott's.

he reached a point directly over the nest. From it he made frequent short sallies in its direction or flew to a neighboring weed from which he chipped his alarm, ending usually by eating the food himself. Still later in the afternoon it was found that the male had overcome his misgivings sufficiently to bear his part in the labor of supplying the young with food. The following day the birds became more oblivious to the camera as well as to the presence of an observer. Several exposures were made, some of which are reproduced herewith. By this time one could seat himself a little distance from the nest and the birds would come and go without displaying any apparent fear. They were ready now for the more complete observations, which were made the following day.

On June 7th, then, observations were begun at daybreak and continued until twilight, when the birds ceased from their toil. The appended record is of course incomplete in many ways, and would therefore be more valuable had it been possible to identify with certainty all of the insect forms fed. However, it is instructive even as it is.

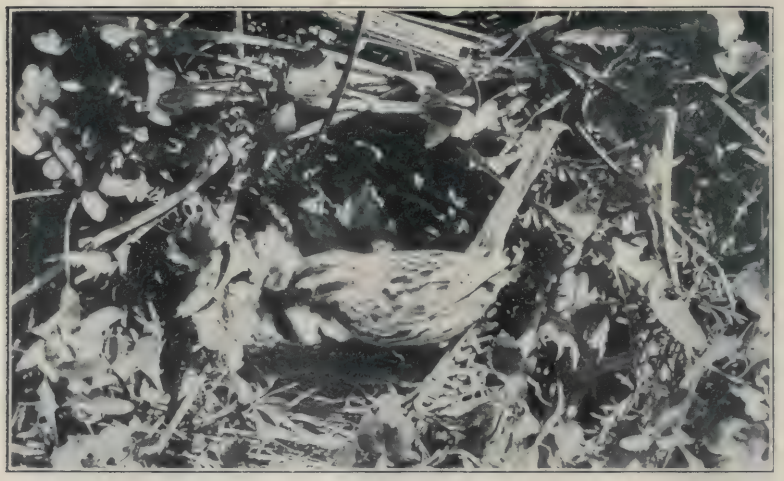
When the nest was discovered it contained six visable young. The day following its discovery one dead nestling was removed, evidently crowded to suffocation. When on June 7th the young were removed to be weighed another young one in a state of semi-putrefaction was found buried beneath those more fortunate to survive. Evidently, it too, had been overcome by its stronger relatives. In addition, an egg was found just outside of the nest. It appeared to be normal in every way. Two of the nestlings were larger than the others. On the day of the observations their feathers were rapidly growing and they were able by the use of their wings, to flutter out of the nest. The other three were considerably smaller, with pin feathers just developing in the tracts of the wings. The two larger ones left the nest the following day and the smaller ones three days afterward.

The records follows:

Weather: Clear; light frost; no perceptible movement of air.

The parent birds began to fly about at 3:45, and at 4:00 visited the nest and removed excreta. Evidently, from later observations, only the female gained the nest. The increase in the light made observation more easy.

Time of feeding	Parent feeding	Food brought	Excreta removed
4:05	♀	green canker worm	
4:10	♀	green canker worm	
4:12	♀	?	
4:18	♀	green canker worm	
4:22	♀	green canker worm	
4:25	Nestlings removed and weighed. Weight, 91.4 grams. Parent birds disturbed by the removal of the young.		
4:28	♀	green canker worm	
4:36	♀	?	
4:46	♀♂	?	x
4:48	♀♂	?	
4:54	♀♂	?	
4:56	♀♂	?	
4:59	♀	green canker worm	
4:59½	♂♀	?	
5:04	♂♀		
5:04	♂	brownish canker worm	



FEMALE WITH CANKER WORM.

Time of feeding	Parent feeding	Food brought	Excreta removed
5:06	♀	brownish canker worm	
5:06	♂	?	
5:10	♀	green canker worm	x
5:10	♂	?	
5:11	♀	green canker worm	x
5:13	♂♀	?	
5:15	♀	?	
5:17	♂	green canker worm	
5:19	♂♀	green canker worm	x
5:25	♀	green canker worm	
5:29	♀	several brown canker worms	
5:30	♂	brown canker worm	
5:34	♀	brown canker worm	
5:37	♂♀	brown canker worm	x
5:38	♀	brown canker worm	
5:39	♂	brown canker worm	
5:44	♂♀	?	
5:52	♀	yellowish green caterpillar	
5:53	♂	?	
5:58	♂	brownish canker worm	
5:58	♂♀	brownish canker worm	
6:00	♀	brownish canker worm	x
6:01	♂	brownish canker worm	
6:03	♂	brownish canker worm	x
6:05	♀	greenish canker worm	x
6:06	♀	?	
6:07	♂	brown canker worm	
6:08	♀	?	
6:10	♀	brown canker worm	
6:15	♂	green and a yellowish canker worm	
6:15	♀	brown canker worm	
6:19	♂	grey moth	
6:19	♀	brown canker worm	x
6:25	♀	2 brown canker worms	x
6:30	♀	brown canker worm	x
6:30	♂	brown canker worm	
6:31	♀	green canker worm	
6:34	♀	2 brown canker worms	
6:34	♂	green canker worm	
6:40	♀	green canker worm	
6:40	♂	gray larva	
6:45	♀	brown canker worm	
		green canker worm	x
6:47	♀	green canker worm	
6:48	♂	brown canker worm	
6:55	♀	green canker worm	
		brown canker worm	
7:00	♂	green canker worm	
		brown canker worm	
7:00	♀	2 green canker worms	
7:05	♀	2 green canker worms	x
7:06	♂	brown canker worm	x
7:11	♂♀	2 green canker worms	x
7:11	♀	1 green canker worm	x
		1 brown larva	
7:15	♂	1 brown canker worm	
7:16	♀	1 brown canker worm	
7:20	♂	2 brown canker worms	
7:23	♀	3 canker worms	x
7:30	♀	green canker worm	x
7:31	♂	2 green canker worms	
7:35	♀	2 green canker worms	
7:38	♂	brown canker worm	x
7:40	♂♀	brown canker worm	
7:42	♀	2 green canker worms	x
7:45	♂	?	
7:48	♂	brown moth	
7:52	♂	green canker worm	x
7:52	♀	?	x
7:58	♂	2 green canker worms	
8:00	♀	brown canker worm	
8:01	♀	green canker worm	x
8:05	♀	green canker worm	x
8:07	♀	brown canker worm	x
8:10	♀	brown canker worm	
8:14	♀	2 green canker worms	x
8:15	♀	?	
8:15½	♂	green canker worm	
8:17	♀	brown canker worm	x
8:20	♀	yellowish worm	
8:23	♂	2 green canker worms	

Time of feeding	Parent feeding		Food brought	Excreta removed
8:23½	♀		green canker worm	
8:26	♀	2	green canker worms	x
8:29	♂		green canker worm	x
8:30	♂	2	green canker worms	
8:35	♂	2	yellowish worms	
8:36	♂		green canker worm	x
8:37	♂	2	green canker worms	x
8:37	♀	1	green canker worm	
8:42	♀		green canker worm	
8:43	♂	2	green canker worms	
8:44½	♀	1	green canker worm	x
8:46	♀		green canker worm	x
8:49	♀		green canker worm	
8:49	♂		green canker worm	x
8:52	♂		green canker worm	
8:54	♂		green canker worm	x
8:59	♀		brown canker worm	x
9:04	♀	1	moth 2 yellowish larvae	x
9:06	♂		green canker worm	x
9:07	♂		green canker worm	x
9:12	♂		yellowish worm	x
9:14	♂	2	green canker worms	
9:15	♂		green canker worm	
9:18	♂	2	green canker worms	x
9:22	♂		green canker worm	x
9:24	♀		green canker worm	x
9:29	♀		yellowish canker worm	
9:32	♀		green canker worm	
9:42	♂		green canker worm	x
9:48	♂	2	yellowish canker worms	
	♀	1	yellowish canker worm	x
9:56	♀		brown moth	x
9:58	♂		brown canker worm	x
10:00	♂	2	green canker worms	x
A garter snake approached the nest. The male attacked it and drove it away, alighted and sang.				
10:02	♀		brown canker worm	x
10:04	♀		green canker worm	
10:06	♂		brown moth	
10:08	♂		green canker worm	
10:11	♂		yellowish canker worm	
	♀♂		brown canker worm	x
10:15	♀♂		brown canker worm	x
10:18	♀	2	green canker worms	
10:19	♀		brown canker worm	
10:20	♂		light colored larva	
10:21	♂		brown canker worm	x
10:23	♀		brown moth	x
10:24	♀			

BOTH PARENT BIRDS AT THE NEST.
UPPER ONE, FEMALE; LOWER, MALE.

TWO OF THE NESTLINGS ALMOST READY TO LEAVE NEST.

Time of feeding	Parent feeding	Food brought	Excreta removed
10:25½	♀	green canker worm	x
10:27½	♂	brown canker worm	
10:28	♂	small insect	
10:29	♀	brown canker worm	x
10:38	♂	brown canker worm	
10:40	♀	green canker worm	
10:43	♂	yellowish canker worm	x
10:46	♀	green canker worm	
10:52	♀	green canker worm	
10:53	♂	small insect	
10:55	♂	greenish yellow worm	x
10:56	♀	green canker worm	x
10:57	♂	small insect	
11:02	♂	green canker worm	
11:04	♂	grey moth	x
Interrupted by visitors. Birds evidently annoyed.			
11:12	♂	green canker worm	
	♀	green canker worm	
11:15½	♀	?	x
11:16	♂	green canker worm	
11:21	♀	small insect	x
11:21½	♂	?	
11:25	♂	greenish canker worm	
	♀	?	
11:27	♀	small insect	
	♂	green canker worm	
11:30	♀	green canker worm	x
11:31	♂	green canker worm	
11:35	♀	green canker worm	
11:37	♂	greenish yellow worm	
11:43	♂	large caterpillar, probably cutworm. Fed part and carried part away.	
11:47	♂	2 green canker worms	x
11:49	♀	small insect	
11:52	♂ & ♀	?	x
11:57		small insect	
One of the young birds left the nest and climbed up the bank and into the grass.			
12:00M.	♀	white moth	x
12:04	♀	?	
12:05	♂	green canker worm	
12:10	♀	yellowish moth	
12:14	♀	?	x
12:14½	♂	green canker worm	x
Another nestling climbed out over the edge of the nest.			
12:19	♀	?	
12:21	♀	white moth	
12:24	♂	white moth	
12:29	♂	canker worm	x
12:35	♀	yellowish moth	
12:36	♂	green canker worm	
12:40	♂	green canker worm	x
12:45	♂	moth	x
12:48	♀	white moth	
12:50	♂	?	
12:54	♀	white moth	
12:59	♂	white moth	
1:03	♂	green canker worm	x
1:11	♂	green canker worm	x
The two nestlings that had left the nest were captured and placed in a box. By their cries they were attracting the parent birds to the neglect of those remaining in the nest. They were placed back in the nest at 3:20. It is likely that they left on account of the exposure to the sun's rays. The grass had to be laid back for observation.			
1:20	♀	green canker worm	x
1:22	♂	moth	
1:26	♀	moth	
1:30	♂	green canker worm	x
1:36	♂	moth	
1:42	♂	moth	

Time of feeding	Parent feeding	Food brought	Excreta removed
2:00	♀	moth	
	Here it was noted that the female had been absent for some time. She returned with feathers wet, and located herself in the swaying top of a neighboring wild parsnip and began to preen and dry herself. Evidently she had been indulging in a bath.		
2:20	♀	green canker worm	
2:22	♀	green canker worm	
2:27	♀	dragon fly	x
2:30	♀	green canker worm moth	
2:33	♀	green canker worm	x
2:40	♀	green canker worm green canker worm	x
2:41	♀	brownish moth green canker worm	
2:50	♀	green canker worm	
2:54	♀	brown moth	
2:55	♀	?	x
2:59	♀	?	x
3:00	♀	green canker worm	
3:03	♀	green canker worm	
3:07	♀	?	
3:15	♀	?	x
3:16	♀	green canker worm	x
3:20	♀	2 brown caterpillars	
3:21	♀	?	
	The long series of feedings by the female is accounted for by the fact that the male was concerned with the two nestlings confined in the box. Attracted by their cries, he alighted in the nearby hawthorns and by chirpings and nervous movements displayed his evident alarm for their safety. The nestlings were returned to the nest at 3:20.		
3:27	♂	2 brown canker worms	
	♀	1 green canker worm	
3:30	♀	?	
3:34	♀	green canker worm	
3:35	♀	green canker worm	
3:40	♀	3 green canker worms	
3:44	♂ & ♀	1 green canker worm	x
3:47	♀ & ♂	green canker worm	
3:52	♀	2 brown canker worms	
3:54	♀	?	
	♂	?	
3:56	♀	green canker worm	x
3:57	♂	?	
4:00	♂ & ♀	?	
4:02	♀	?	
4:04	♂	dark colored insect	
4:05	♀	green canker worm	
4:06	♂	?	
4:08	♀	?	
4:11½	♀ & ♂	?	
4:19	♂	green canker worm yellowish insect	x
4:20	♀	dark colored insect	
4:23	♂ & ♀	each a canker worm	x
4:27	♀	2 green canker worms	x
4:30	♂	green canker worm	
	♀	green canker worm	x
4:33	♀	green canker worm	x
4:40	♀ & ♂	5 canker worms	
4:44	♂	3 green canker worms	
4:46	♂ & ♀	?	
4:48	♀	green canker worm	x
4:49	♂	brown moth green canker worm	
4:50	♂ & ♀	4 green canker worms	
4:53	♂	?	
5:00	♀	3 green canker worms	x
5:06	♀	1 green canker worm	x
	♂	?	
5:13	♀	3 green canker worms	x
5:21	♂	3 brown canker worms	
	♀	2 green canker worms	
5:24	♀	4 white larvae	x
5:30	♂	3 brown canker worms	
5:35	♂	green canker worm	
5:36	♀	4 white larvae	x
5:39	♀	dragon fly	x
	She tore it apart and fed to several of the nestlings, then ate the rest herself.		
5:43	♂	2 white larvae	x
5:45	♀	?	x
5:47	♂	1 brown worm 1 light colored	
5:50	♀	2 brown canker worms	
5:51	♂	1 large dark colored larva 1 brown canker worm	x
5:54	♀	2 white larvae	
5:55	♂	1 large black larva 1 small black insect	
	♀	2 white larvae	x
5:59	♂	?	
	Returned with 2 green canker worms. Ate them herself and sat in weed cleaning herself until return of male.		
6:02	♀	2 green canker worms	
6:06	♀	2 green canker worms	x
6:09	♀	2 brown canker worms	x
	♂	1 green canker worm	
6:15	♂	1 green canker worm	
6:18	♀	green canker worm	x
6:19	♂	?	
6:22	♀	2 green canker worms	x
6:26	♂	1 brown canker worm	
6:27	♀	brown canker worm	
6:30	♂	brown canker worm	x
	♀	brown canker worm	
6:36	♂	white moth	
6:38	♂	small insect	x
6:41	♂	small insect	
6:50	♂	green canker worm	
	♀	brown moth	x
6:59	♀	small insect	
7:04	♀	green canker worm	
7:09	♂	?	
7:13	♀	green canker worm	x
7:16	♂	larva	
7:23	♀	?	
7:35	Twilight setting in. Parent birds feeding infrequently; after feeding remaining near the nest.		
	Young birds carefully removed from the nests and weighed. Weight, 100.7 grams.		
	Nestlings returned to nest and observations discontinued.		

A summary of the record may be made as follows:

Male fed young, 126 times.

Female fed young, 177 times.
Total, by both parents, 303 times.
Average interval between feedings, 3 minutes.
Excreta removed, 109 times.
Weight of nestlings at 4:25 A. M., 91.4 grams.
Weight of nestlings at 7:35 P. M., 100.7 grams.
Increase in weight, in 15 hours, 9.3 grams.
Percentage increase in weight, 10.1.

The day following the one on which the record was made furnished opportunity to collect several of the pellets of excreta. The two larger nestlings had left, hence the calculation must be by so much in error. The average weight of these pellets was .2 of a gram. It must be noted also that these were obtained by gently pressing upon the bodies of the nestlings, hence must have been considerably under the average size of those expelled under natural stimulus. However, the observation was frequently made that the parent birds carried away masses of excreta of considerable variation in size. Assuming, however, that .2 gram represents the approximate weight of the excreta masses, it results in the quantity of 21.8 grams, as the total removed from the nestlings during the day. As previously noted, the grasses and weeds shading the nest were removed or turned aside in order that the nest might be more easily observed. This resulted, of course, in exposing the nestlings to the direct rays of the sun. Evaporation from their bodies, as well as the amount of water vapor in the expired air, must have been considerable. There was no way of determining this. The gain in weight together with the weight of the excreta removed, amounts to 31.1 grams; an amount which would be greatly increased did we know the weight of the water lost. It is evident that the weight of the food for the period covering the observations must have been at least over 40 grams.

An effort was made to obtain some of the larvae in order to identify them. This did not prove practicable, since in feeding, the parent birds mutilated them badly. The moths appeared to be those whose larvae are cutworms and sod worms, though of course, there could be no certainty with reference to their identification. It is noticeable that during the middle portion of the day the number of moths fed was much greater than at any other time.

In the record the term canker worm is used since such are popularly known to be destructive. Of these several species were being fed. From what plants they were being obtained could not

be determined. Some times the old birds flew into the meadow and at other times, and more frequently, over the thicket where were wild gooseberry, cherry, haws, and other shrubs and trees.

The parent birds were not observed to eat the masses of excreta, though it is possible that they did. They always left the nest quickly and flew some little distance with the masses in their beaks. None were found to have been dropped near the nest.

The fact of the rapid increase in the weight of the nestlings is in conformity with the observations made by many others. If, however, we carry it over and assume a similar rate of growth in the human young, it becomes especially striking. Assuming that to a baby weighing seven pounds, food was supplied in a correspondingly large amount, and that the baby could digest it with equal facility, the baby would then grow to average adult proportions and weight of 150 lbs. in less than a month. Now after the nestlings have left the nest, they are fed and cared for by their parents for at least two weeks, before they begin to acquire the ability to shift for themselves. Our baby, then, now grown to adult weight, would receive further care and doubtless all of his education, in a little over another month's time, after which he would be expected to take his place in the world and shift for himself. This rapid growth and development on the part of the young birds is, of course, a remarkable adaptation since it permits of their being reared while food is plentiful, and, too, enables the young to harden and adjust themselves to their necessities before the time of migration sets in.

One cannot have observed birds such as these busy ones bringing to their young, with ceaseless regularity, large numbers of insect larvae, many of which are known to be destructive to man's interests, without coming to an appreciation of the great value of the bird. In addition to the song sparrow are many others whose feeeding habits are similar. If not disturbed, many species of birds nest within the area of an acre, and in a square mile there may be scores or even hundreds of nests. Multiply then the work for a single day, of a pair of song sparrows by scores of hundreds and one has the result of birds' efforts in feeding their young. As a factor in keeping down the insect hosts, they cannot be overestimated. They are one of Nature's checks in preserving the balance.

It is only fair to append the names of those who assisted in the observation, since to them, as well as to the writer, belongs the credit for this paper. They are: Louise Boswell, Bertha Cramer, Myrtle Drury, Emma Foy, Marion Hayward, Alma Henricks, Florence Moses, Ida Smith, Lola Swift, Genevieve Vernor.

Editorial

Almost every month some one or more of the popular magazines give prominence to an article on the lack of efficiency in the public schools. These articles call attention to the fact that the public schools succeed in driving away from them the great majority of the pupils who enter them so that before the high school is begun a large percentage of the children who enter the grades have already fallen out. Furthermore the articles emphasize the fact that much of the work that is given in the schools is relatively useless to the child who must enter the commercial world to win from it a living. Now I would not for a moment attempt to check the spirit of dissatisfaction with the achievement of the schools which is voicing itself in these current magazines. Only a thorough realization of how defective our education really is, and how effective it may be, will stimulate the rapid progress which is desirable and which is to be achieved. Yet I would have in all our efforts a spirit of optimism. No one is more thoroughly awake to the responsibilities that rest upon the schools and the new demands which are being made upon them than is the school man himself. Any one who attended the summer sessions of the N. E. A. must have felt that the school men are alert to the problems of their profession and are steadfastly facing the difficulties involved. The atmosphere of the meeting was optimistic. There were a number of inspiring speakers, a confusing array of inspiring topics and stimulating discussions, but the most suggestive thing of the entire week was the large attendance and the persistency with which these people went to the various sessions earnestly attentive to the discussions in hand. The program was optimistic in its very appearance. Elementary agriculture, nature-study, domestic arts, vocational training, and all these newer phases of education received a large share of attention. The papers presented accomplishments rather than theory. The American schools are certainly occupying the promised land of their opportunity.

There comes to the editor's desk the two volume Report of the Commissioner of Education for 1911. This is a document to reinforce the impressions gained at the summer meeting. No tone of pessimism lurks in its pages. Every teacher would do well to possess these volumes, at least to read carefully the Introductory Survey of Volume 2, so that he may feel himself enthused with the achievements of a decade, and may be proud of the fact that he is a part of this rapid progress. In that time there

has been an increase in the length of the school term, in the average attendance, in the number of teachers, in the salaries, in the values of public school property, in the number of pupils, and all by generous percentages. A good deal of space is given in these volumes to agricultural and industrial education, to the physical fitness of the pupils, to increased use of the school plant for community interests other than strictly school interests, to moral education and the uplift of the community. Never before has the child occupied so large a place in the interests of the nation. Never before have the problems of his welfare and normal development occupied so large a share in the attention of eminent scholars. All of the influences that tend to his welfare are receiving a juster share of publicity, and those social vices and economic evils that prove injurious to the child are meeting with more hearty condemnation. The schools must prepare the child to earn a living and to live his life. Nature-study makes its contribution to these aims and its contribution is no means one. Man wins his livelihood from Nature and the study of her laws and methods of operation is essential to intelligent progress. The contemplation of Nature has always led men on into that thinking, that attitude of mind, that larger life and broader vision that make life worth the living.

"NATURE never did betray
The heart that loved her; 'tis her privilege
Through all the years of this our life, to lead
From joy to joy; for she can so inform
The mind that is within us, so impress
With quietness and beauty, and so feed
With lofty thoughts, that neither evil tongues,
Rash judgments, nor the sneers of selfish men,
Nor greeting where no kindness is, nor all
The dreary intercourse of daily life
Shall e'er prevail against us, or disturb
Our cheerful faith, that all that we behold
Is full of blessings."

News and Notes

The publisher of the magazine must certify to the postal authorities in order to get the second class rates that the subscription list is "paid in advance." The REVIEW has been lenient heretofore. It is now in financial position to change its policy. The date of expiration of your subscription is now on your label. If you desire the magazine please pay before the old subscription expires. This is the last issue that will be sent to any who have not paid in advance.

Article III of our constitution provides that "Members paying twenty dollars at any one time shall be enrolled as life members exempt from annual dues. Any person paying to the Society one hundred dollars shall be permanently enrolled as a patron and entitled to all the privileges of members. All moneys collected from life members and patrons shall, under the direction of the Council, be invested as a permanent fund and only the income used for expenses of the Society." Since the last issue we have enrolled our first life members. They are: Miss Cecelia Baldwin McElroy and Seth Bunker Capp, both of Philadelphia, Pa.

The Annual Election of the Society will occur in December at which time a president, five vice-presidents, five directors and the secretary-treasurer are to be elected. B. M. Davis is now President. The Vice Presidents are M. A. Bigelow, Anna B. Comstock, S. Coulter, D. J. Crosby, F. L. Holtz. The Directors whose terms expire this year are E. B. Babcock, Otis W. Caldwell, Anna B. Comstock, J. Dearness, Ruth Marshall. The Constitution (Article IV) provides: "The Council shall make nominations for all offices and publish them in the official journal before November fifteenth of each year. Members and fellows shall have the right to suggest nominations by mail, and any name thus receiving at least twenty-five votes before October fifteenth shall be published with the nominations by the Council." Any members having nominations to make will please send the names to the editor who is also the Secretary-Treasurer.

B. M. Davis, the president, sent in one list of fifty new subscribers to the REVIEW this summer. J. Dearness of Ontario also turned in a goodly number.

C. W. Finley conducted the Nature Study courses at Chautauqua, N. Y., this summer.

The joint meetings of the American Nature Study Society, the American Garden Association and the Department of Elementary Agriculture of the N. E. A. were interesting occasions. Some excellent papers were presented and the discussions were lively and to the point.

Geo. D. Miller and W. L. Eikenberry of the University of Chicago High School Conducted a party of fifteen boys on a five weeks' Nature Study Outing in the Yellowstone this summer.

The course in elementary agriculture in Miami University were crowded to the limits this summer. The new state law making the teaching of the subject compulsory in the rural schools sent teachers to the sources of information. B. M. Davis had over two hundred in one course.

Teachers in the United States who wish to exchange specimens with Porto Rican teachers or who wish to establish exchanges between their pupils and Porto Rican pupils, may secure the addresses of Porto Ricans who will make exchanges by writing to Prof. E. A. Cockefair, College of Agriculture, Mayaguez, P. R.

There are many things here which should interest children of the States and many in the States which are curiosities here, e. g. wheat in the grain or in the head are unknown objects here, while the cocoanut and cacao abound.—F. L. Stevens, Dean, College of Agriculture.

Mr. W. W. Atwood, Secretary of the Chicago Academy of Science, has been doing field work with a party of students in the Rocky Mountains the past summer.

C. F. Hodge, member of the Council of the American Nature Study Society, spent some time in Wisconsin this summer investigating the reported appearance of the wild pigeon. He was not rewarded by any visible evidence of the birds however. On his return he spent a couple of days in the School of Education lecturing twice to appreciative audiences on "Methods in Nature Study" and "The Extermination of the Typhoid Fly."

Book Reviews

The Arctic Prairies. By Ernest Thompson Seton. 415 pages. Charles Scribner's Sons, New York, 1911, $3.00.

The large number of readers of books by Ernest Thompson Seton will be interested in this latest book from his pen which is the outcome of a two thousand mile canoe journey in the extreme northernmost portion of North America. Mr. Thompson made this trip in order to determine the present numbers and distribution of the buffalo and caribou in the northern country. The trip was made through regions that are still largely uninhabitated except by employes of the Hudson Bay Company and various tribes of Indians and scattered settlers that are more or less related to the industries in which the Hudson Bay Company is interested. Naturally the journey had to be made by waterways with numerous portages in the headlands. With Indian and half-breed guides who were thoroughly familiar with the waterways the party spent many months in their investigations. The book contains many references to natural history features which are presented attractively through Mr. Thompson's unique method of description and through his sketches.

It seems that the number of buffalo still ranging as wild animals on the northern prairies is relatively small, the author estimating that there were perhaps 300 in the region through which his journey took him. But the number of caribou is surprisingly large. He describes times when in camps the caribou in large columns would pass his camp continuously for days and nights. He estimates that there must be still running wild in the northern praries at least thirty million caribou, "and maybe double of that." From data that he collected he also estimates that the Indians kill about 40,000 of this number per year and that many are killed by other hunters. Notwithstanding this fact the natural reproduction must be several millions per year, enough to "far overbalance the hunter's toll so that the latter cannot make any permanent difference. From the data collected it seems evident that the numbers of buffalo and caribou fluctuate in accordance with the increase and decrease of the number of wolves. Wolves and rabbits in the northern country increase with considerable rapidity, the latter becoming so numerous as to be literally everywhere in some years. When the number of these animals become so very large disease spreads among them and they are suddenly reduced to such an extent that it is rare that one

sees an animal of their kind. During those times of low numbers of wolves, obviously the young of the caribou and buffalo suffer less from attacks and the herd increases. When wolves are numerous, a corresponding reduction in increase of the herds of caribou follows. This is but a suggestion of the interrelations of life that our ecologists have just begun to study in our native wild regions.

The book is interesting throughout, its material is presented in an easy-going, conversational style characteristic of the author, and will be found well worth the reading to those who have already learned to fancy Mr. Thompson's style.—O. W. C.

Animal Secrets Told. A Book of "Whys." Harry Chase Breardley. XII + 274 pages, 12 half-tone illustrations by Elmer R. Sandborn, Official Photographer, New York Zoölogical Society, and 72 Illustrations from drawings by the Author. Frederick A. Stokes Company, New York, 1911, $1.35.

As the title indicates, the book is a discussion of "Nature's reasons" for structural modifications. The subject matter is discussed in chapters on eyes, noses, ears, mouths, tongues, teeth, bills, feet, tails, coverings and protection. In the chapter on ears, the rabbit's ear, the bloodhound's ear, the elephant's ear, the hippopotamus's ear, the owl's ear, and the human ear are discussed. Following are some of the conclusions reached as to the reasons for the shape and position of these structures. The rabbit's ears are long so that they will protrude above the grass in which he sits thus making it possible for him to hear in this position. The bloodhound's ears have large flaps which hang down over the ear opening so as to shut out sounds thus making it possible for the dog to concentrate his attention on scent. The elephant's ears are large and fan-like so as to assist in catching sounds after nightfall, and are made to fold back on the neck in order that they may not be torn to ribbons. The hippopotamus's ears are placed on the top of the head so that they will remain above the water when the rest of the animal is submerged. The human ear is not capable of movement because of the fact that man, being a two-legged animal, can rapidly wheel about in any direction thus making ear movement unnecessary.

It is seen that the discussions are extremely teleological and that the author has confused reasons for structure with probable structural function. In all the recent research in zoölogical problems very little light has been thrown on factors affecting structural modifications and it is to be regretted that a book should

come out so unscientifically disposing of these weighty questions.—C. W. F.

Butterfly Hunting in Many Lands. By George B. Longstaff. Longmans Green & Co., New York. Pp. xviii + 728, $7.00.

This book is one of those delightful combinations of records of travel and observations of a naturalist that make fascinating reading for any one who enjoys both travel and natural history. The book is a personal narrative and with the author you travel around the world picking up insects under all sorts of interesting conditions, chasing rare butterflies in Ceylon, and exclaiming with him as you find a rare bettle in South America. Chapter X is a good discussion of butterfly bionomics, while the Appendix contains translations of Fritz Müller's papers on the hair tufts, scent organs and sex spots in certain of the butterflies and moths. The Appendix is illustrated with reproductions of Müller's original plates. The body of the book contains a number of plates in color giving figures of some of the rarer sorts. It is a book that any "bug hunter" will enjoy on winter evenings when the pleasures of net and cyanide jar are denied him. And even the layman will enjoy many of the accounts of the journeys and strange experiences, although he will probably want to skip some paragraphs that are made up largely of scientific names. Withal it is a delightful book for a naturalist, partakes of the character of the earlier natural histories, and is fascinating without losing its scientific value.

Sex Hygiene for the Male and What to Say to the Boy. By G. Frank Lydston. The Riverton Press, Chicago, Ill. Pp. 304. $2.25.

A few of the chapter headings will indicate the scope of this work: Methods of Instruction of Youth, 10 pages; The Lie of the Wild Oats, 6 pages; Inspection and Regulation of the Social Evil, 6 pages; Methods of Muscle Building, 12 pages; Bathing and Massage, 5 pages; General Principles of Sex Hygiene, 25 pages; Anatomy and Physiology of the Male Procreative Organs, 18 pages; Diseases of the Procreative Function, 35 pages; Local Venereal Diseases, 40 pages; What to Say to the Boy, 18 pages. Dr. Lydston is a physician of wide experience and this book is only one of several which he has written in his endeavor to increase the knowledge of sex hygiene and to stimulate higher social ideals. The book is frank, and specific in its recommendations both for the individual and society. He states his belief on sex

education as follows: "The field of sex education is new—so new that we must begin at the top—begin by 'educating the educators.' Small wonder that teacher, parent and physician hardly know where to begin or how far to go. Mistakes are bound to be made on the way—the reformer is always radical, thank heaven! and always swings a little too far. The time will come when sex hygiene will be a natural and inevitable part of education, and those whom we fain would instruct will no longer blush—still less will they giggle. Meanwhile, let us bear up under the giggling of the present generation in the security of the belief that braving the giggles of today may help to check the tears of tomorrow."

The Evolution of the Vertebrates and Their Kin. By William Patten, Ph. D. P. Blakeston's Sons & Co., Philadelphia. Pp. xxi + 486; 309 illustrations. $4.50.

Any one who has attended the yearly meetings of the American Association for the Advancement of Science has repeatedly heard papers by Dr. Patten and his students and has seen models of the animals which he considers the ancestors of the vertebrates, but there was no book in which one could find a statement of his interesting views until the appearance of this admirable volume. The book is not intended for the amateur but only for one who is willing to wade deeply in the conflicting currents of opinion regarding the interpretation of embryological and morphological facts. Dr. Patten presents his evidence of the rise of the vertebrate from an arachnid ancestry in a masterly way and explains so many of the peculiarities of vertebrate anatomy thereby that it is difficult to get away from his conclusions. It is a book that every student of evolution will welcome as a valuable contribution to the discussion of possible lines of ascent.

Ab, The Cave Man. By William Lewis Nida. A. Flanagan Company, Chicago, 166 pp. 50c.

In the preface to this little book the author says:

"For nearly a dozen years it has been my pleasure to observe the intense interest shown by second grade pupils as they listen to the 'Story of Ab' from the lips of their teachers. No other book available has held our children so completely in its spell.

"By special arrangements with Messrs. Doubleday, Page & Co., and Mr. Waterloo, the author of 'Ab', the work is now ready for the little folks."

On the theory of recapitulation it is supposed that the average

child passes through at some time in his development a stage comparable to that condition of savagery in which Ab, the Cave Man lived. The story certainly gives a vivid picture of the life of those early years as imagination reconstructs it—a picture that is probably moderately accurate since so many of the implements of the Stone Age are preserved for us.

The student of Education has frequently been premature in adopting and applying biological theories which have later been discarded by the biologist but which have persisted tenaciously in educational literature. It will be interesting to see if the author's experience is confirmed by other teachers who use the book. The recapitulatory theory, except in very broadest outline is discarded by the biologist, and so far as the reviewer has had opportunity to test this story, children seem repulsed by it rather than fascinated. Only a wider experience can determine how permanent the story will be in the list of children's favorites.

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... 68-American Woodcock.
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OFFICIAL ORGAN OF

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VOL. 8 OCTOBER, 1912 NO. 7

Daffodils

BY WILLIAM WORDSWORTH.

I wandered lonely as a cloud
That floats on high o'er vales and hills,
When all at once I saw a crowd,
A host, of golden daffodils;
Beside the lake, beneath the trees,
Fluttering and dancing in the breeze.

Continuous as the stars that shine
And twinkle on the milky way,
They stretched in never-ending line
Along the margin of a bay:
Ten thousand saw I at a glance,
Tossing their heads in sprightly dance.

The waves beside them danced, but they
Outdid the sparkling waves in glee;
A poet could not but be gay
In such a jocund company.
I gazed—and gazed—but little thought
What wealth the show to me had brought.

For oft when on my couch I lie,
In vacant or in pensive mood,
They flash upon that inward eye
Which is the bliss of solitude;
And then my heart with pleasure fills,
And dances with the daffodils.

The School Garden and Fundamentals of Education

Otis W. Caldwell.

University of Chicago.

When Gladstone stated that "one example is worth a thousand arguments," he expressed an idea which should be more widely recognized in education. We too often state the educational values that may be derived from some particular activity, with too few examples showing these values in process of realization. Much good garden work has already been done in the United States, and much is now in progress, and possibly it may be safe to judge what has been accomplished in an attempt to state some of the ways in which gardens appear to relate to fundamentals in education.

I. What Do We Mean by School Gardens?

At the outset it should be noted that the content of the term "school gardens," has grown beyond what we at first meant when we thought of a small patch of cultivated ground at the side of the schoolhouse. "Gardens by school pupils" would more nearly express the present scope of the term, for we include indoor and outdoor cultivation at the school, vacant lot gardens, whether managed by groups or single pupils, boys' and girls' corn club and flower gardens, and home gardens, where teacher, pupil, and parents co-operate and even community gardens in which a whole family may work together. The whole garden movement is included in whatever form it may express itself as a means of education. If we include in content only what is being done at school, we omit the aspects upon which we hope to bring most influence to bear. Unless school work secures reactions in home and community life, it misses its aim. Home and community life should regularly be used as the basis of school work and there is need for gardens at the school only when they cannot be had at home, or when for some demonstration or experiment, group work is needed. I wish to include everything from sixth story apartment window boxes to school window boxes, group and individual school gardens, home gardens by pupils—vegetable, flower, and horticultural—community gardens and educative farm experiments, such as Jerry Moore's one-acre corn plot in South Carolina, from which single acre this boy produced

228.3 bushels of corn. Gardens that yield results in materials, practice, thought, and knowledge, thus yielding results in the lives of pupils, are all within the boundaries of the educational idea of the garden movement. The content is determined by what the garden is for, whether pupils work in it and whether it is for education in thought and independence, rather than by what or where the garden is located.

II. The Garden as a Means of Motivation.

In one sandy and relatively unproductive section of Chicago, I have seen many boys who had spent much time in streets and on vacant lots motivated, unified, and directed in their efforts by the idea of producing things of value and beauty from the soil. I recall one twelve-year-old boy who fenced in an unpromising and small piece of sandy soil, and by his own efforts grew vegetables that supplied his mother. When I visited his garden, twenty-eight species of flowering plants were in flower. He reminds one of Kropotkin's statement that "In the hands of man there are no unfertile soils." He faithfully tended his garden, and at the close of the season asked for school work which would better fit him for larger garden ventures in the following season, but, unfortunately for him, and to the disgrace of our system of education, the school could not supply further instruction in the very pursuit that had stimulated this boy and had made education seem worth while to him. It is futile to multiply cases such as that just cited. They are within the experience of every one who has had much experience in first-hand contact with this question. Many an aimless boy and girl has found motive, has found work that seemed worth while to him. All too often the school has been unable thereafter to meet the pupil's need for further education by means of and through the thing that has stimulated him.

III. The Garden as a Work Place.

In our educational practice, we seem most slow in incorporating into our educational practice the well-known fact that pupils "learn by doing." From our own personal work, and from our teaching wherever we have allowed our students to work, we have found that the best interest and best educative quality are derived when work and study, body and mind, go together. In the garden the imagination forecasts results to be secured. A drawing may have depicted these imagined results before garden work began. A drawing may even show in detail the distribution and color of plants that make up the whole

garden. Possibly the imagination foresees fine vegetables to be used or sold in the market. Tilling the soil, selecting and planting the seed, weeding, cultivating, and watering all become parts of the processes involved in letting the imaginary garden become as near a reality as the situation will permit. Work is purposeful, and study of seedlings and growing plants, soils, and unfavorable agencies as parasites are necessary as parts of the general purpose and plan. Self-activity increases interest and belief in what is done and begets a sense of responsibility for the work, as well as a pride in it.

Our whole course in elementary science for the grades needs to embody more work by pupils on really significant topics, and less talk by both pupils and teacher about phases of nature that may give some promise of interest, but little promise of significance or educative quality. We shall have fairly good elementary science if nothing beside garden work is done, if that is well done, and on a broad basis. Most would prefer much beside the garden in the elementary science course, and with that I should agree, but we should do more for educating children if we touch much less in the course and do what is done with the kind of significant purpose and first-hand contact that garden work presents.

IV. Value of Garden Products.

While usually the total value of things produced in pupils' gardens is not large, it may sometimes be considerable, and in any event, it may reach a value of importance in the pupils' eyes. To have earned a little money through garden work has oftentimes produced, even in pupils who have plenty of spending money, a feeling of pride, that is a constant surprise to me. I have recently seen a fifth grade child, one who was regularly given spending money, gather regularly the radishes and lettuce she had grown and carry them about to sell them, much pleased that she had really earned money thereby. A sense of ownership, of pride, and of budding independence is of great educational importance. This is the basis of further economic development. The work itself may be the basis for future vocational work, but in any event, it is the basis for understanding and sympathy with certain most fundamental vocations.

V. The Garden and the Utilities.

The demand for more practical materials is being made for both elementary and high schools, and we who advocate this are often accused of seeking a "dollars and cents" education.

An important distinction has been omitted in such discussions. We must have practical materials and economic values will be derived from our science work if it is well taught. But these materials are the ones that are significant in the lives of young pupils, and since they are significant, they make possible a dynamic and purposeful education that materials without utility cannot give. The best education in thought power is developed through real problems, and to young pupils practical problems are real problems. We need the utilities therefore for educative ends, primarily, but in being more educative, they give knowledge of utilities which may readily be turned to account. We have gone quite too far in educational processes that imply that we believe a higher type of education may be secured through materials that in themselves are free from utility. Quite the reverse seems likely to be true, since genuine significance of materials is essential to educational development through use of these materials.

VI. The School Garden and English.

To a science man interested in education, it seems strange that so much effort is made to teach good English through formal drill, when so many real situations, as in garden work call for description and good selection of vocabulary. All the kinds of description—pictorial, verbal, and written—may be based upon garden and other elementary science work, and it has the tremendous value of presenting something which the pupils know about and feel is worth describing. We should need less of our formal study of expression if we had and used more well-thought impressions. English is a vehicle of thought, and we shall use the vehicle better if we learn it while allowing it to operate in its normal capacity in carrying thought. More clear thought and clear expression about realities will reduce the amount of formal drill in language.

VII. What Is of Most Worth in Education?

An education which does not fit people better to produce things of value, to produce things of better quality, and in larger quantity may justly have its values seriously questioned. What is of most worth in education has occupied much time and thought. Our general educational practice is evidence of our conclusion as to what is of most worth in education if we agree pragmatically that what we do in life evidences our real philosophy. If this inference is correct, we must conclude that most school people believe in a relatively abstract education, in assignments and

formal recitations from books, in an education for culture, so-called, an education which is cheapened if the concrete things and realities of life become too abundant, an education which must develop thought power and artistic appreciation apart from the dust and perspiration of productive labor, apart from danger of contact with things of common life. This interpretation of what is of most worth in education has dominated so completely that rich and poor alike have striven to secure for their children a full measure of this kind of education. The evanescent halo that hangs over our cultural education has led many a hard-working parent to make great sacrifices that boys and girls may be educated according to this standard, only to find at the end that the sacrifice has been in vain, the education has left distorted views of labor and industry, and a new start must be made. We need not only advocate the dignity and enjoyment of work, but the disgrace of anything except work, and our education has taught us that really educated people must not engage in productive labor. "Man shall not live by bread alone," but man shall live by bread. There is no poem except in comparison with prose—prose is fundamental and has a truth and exactitude and permeating strength which is fundamental—and upon it is poetry founded. The tragedy of patient, paternal, sacrifice and toil to secure for children an education which too often leaves them stranded and ineffective with false ideals of what is of most worth is occurring so frequently that there is hope just now that we may really understand the tragedy and help to make its recurrence less necessary. That knowledge is of most worth, which having led to growth in thought power and efficiency, at the same time leads to efficient productivity in some real work, a knowledge that leads to a belief in the dignity and worth-whileness of productive activity.

"What is an anecdote Johnny?" asked the teacher.

"A short, funny tale," answered the little fellow.

"That's right," said the teacher.

"Now, Johnny, you may write a sentence on the blackboard containing the word."

Johnny hesitated a moment and then wrote this: "A rabbit has four legs and one anecdote."

—SELECTED.

Indoor Bulb-Planting in Schools

Mary F. Barrett.

In the nature study curriculum the topic of bulb-planting has always proved exceedingly satisfactory.

To begin with, a bulb, as for example, that of the onion, is a familiar, a household object. Moreover it is easy to dissect, and its different parts are large and can be seen and identified without much assistance from a teacher.

Then the study of bulbs and their culture, besides appealing to the practical and the aesthetic senses of children, is of interest and importance as exemplifying certain fundamental botanical principles. In the bulb may be seen the principal parts of a plant, modified it is true, but easily recognized and explained. The preparation of the plant for winter may be noted, the nature of its stored food ascertained, and the presence of food correlated with the time of flowering. The whole cycle of one type of vegetative propagation may be watched, from mother bulb to daughter bulbs, under normal and easily controlled conditions of temperature, of water and other foods. Thus it is obvious that the subject may be considered from many different points of view and may thus be worked into any one of a variety of places in the curriculum.

Finally, if the proper kinds of bulbs are chosen and cultivated in accordance with correct methods, they are sure to be successful, and they are comparatively inexpensive.

The conditions in the State Normal School at Upper Montclair, N. J., are typical of most suburban schools, and an account of the methods there used in treating this subject may be of value as a summary, even if it contributes no new ideas. The students in that school are being prepared to teach in grammar grades, and in the three class appointments devoted to the topic they are given it as they themselves would present it to children. Since most of them live at a distance which would prevent supervision of home-raised bulbs, all the planting is done at the school.

The work is introduced by a preliminary discussion of the values of different kinds of house plants, in which the students are led to distinguish the particular advantages of bulbs.

The following class period, forty minutes is taken up with the examination of a typical bulb and a comparison of it with other bulbs and with a tuber. For typical bulbs old specimens of Chinese lily are used, as being easy to handle and showing well the manner in which new bulbs are formed. The tubers

are white potatoes, recently dug, since these show the markings better than potatoes which have been out of the ground for some time.

As preparation for the next class the students study the summary which is here appended. Formerly they were given merely an outline and were supposed to collect their own data from books, periodical literature and experience. This method was found unsatisfactory, partly because the information was usually either scanty or needlessly detailed, and some of it contradictory, and partly because it was purely empirical, giving no hint of the botanical principles underlying the culture. These were of course to be developed in the recitation following the laboratory exercise, but it proved necessary to present them for consideration beforehand.

The recitation, including a demonstration of food tests, usually takes the class well into methods of out-door planting—a subject which has no place in this article.

At the next class, pot-planting is discussed by the class and demonstrated in detail by the teacher. Then each student, taking the bulb and the labeled stake which she has found at her seat, goes down to the basement laboratory, where she finds all the rest of the necessary equipment and plants according to the directions just received. Each pot is inspected before being placed in the trench mentioned in the summary. In previous years both the garret and the cellar were tried as substitutes for this trench, but were found to have serious drawbacks. In the garret it was difficult to water the bulbs and to protect them from mice, and in the cellar the temperature was too high to stimulate root growth in any bulbs except the varieties of narcissus.

The pots remain in the trench until after the Christmas vacation. Sometimes they are left until February 1st, as it is difficult under school conditions to force hyacinths successfully much before that time. Then on a favorable day they are dug up by the janitor and are cleaned by the students and placed on tables in the center of the basement laboratory, where they may obtain a little sunlight. The hyacinths, as soon as their leaves are about an inch and a half long, are covered with a black paper cone having at its upper end an opening as large as a twenty-five cent piece. This stimulates leaf growth and inhibits premature development of the flower cluster. The soil is watered whenever it becomes dry, and when the flowers open, the plants are used to decorate the rooms in the school. Last year the bulbs were especially fine and were exhibited for three days. Care is taken

of them, after the flowers are gone, until the Easter vacation, when they must all be cleared away. They are then usually transferred to the garden to come up the next year if they are so disposed.

The bulbs at present are bought from a local florist who imports with his own the large quantities of common kinds to be used in window boxes, and obtains the rest from a firm in New York. This is an easy way of getting them and has proved no more expensive than to order them all from a regular bulb dealer. The florist also furnishes bulb soil.

POET'S NARCISSUS—SHOWING ROOTS.

All the students who keep on with the subject of botany throughout the year have individual bulbs, of which there are few duplicates. This makes an interesting variety, although it is decidedly more expensive. The students who complete their course in February and who therefore could not be held responsible for the care of plants after that time prepare the window-boxes, which are of the self-watering type, and start at intervals during the fall a succession of bulbs planted in water. Of course such plants could not be put into a trench, but since they take up little room they are left for a time in an unheated dark closet. Thus the school is provided with a succession of bulb flowers from Thanksgiving to Easter.

The bulbs are principally varieties of narcissus and hyacinth, with only a few tulips since these have been found more difficult to raise. Tender bulbs can not stand the cold

week-ends, and most of the other kinds have other drawbacks. For the window boxes, good contrasting varieties of narcissus are Barrii Conspicua, Emperor, Empress, Golden Spur, Orange Phoenix, Victoria and double *Von Sion;* and of hyacinth, Gertrude, Gigantea, Grand Maitre, Innocence and King of the Blues. In the water culture, Chinese lilies, paper-white narcissus, Soleil d' Or narcissus, and a few hyacinths are used.

No written reports of this work are exacted, as in this particular school their value does not make up for the difficulty and tedium of compiling them. In elementary schools such reports serve as useful exercises in English composition.

BULB PLANTING.

I. Plant parts knows as "bulbs." Of what do they consist?
II. Time of planting.
  A. Hardy bulbs (hyacinths, narcissus, tulips, crocus, snowdrops, scilla, glory-of-the-snow).
    1. Outdoors—not sooner than six weeks before regular frosty nights. In this locality from the middle of October. What would happen if they were planted earlier? Why?
    2. Indoors—about the same time. Bulbs degenerate when kept out of the soil.
  B. Tender bulbs.
    1. Outdoors—spring—ex. cannas, dahlias, etc.
    2. Indoors—same time as hardy bulbs—ex. freesias, ixias, etc.
III. Place of planting.
  A. Outdoors.
    1. In beds—soil should be good, well-drained, light, sunny, rich.
    2. In grass—as nearly as possible like garden.
  B. Indoors.
    1. In soil—soil should be as nearly like garden as possible—loam, leaf-mold and sand. For fertilizer, 1 part of bone-meal should be added to 50 parts of soil.
    2. In water—(some hyacinths, some narcissus, i. e., paper-whites, Soleil d' Or, and Chinese lilies). Water must be kept fresh and unfrozen.
IV. Method of Planting—be sure to have the bulb right side up.
  A. Outdoors.
    1. Depth—a general rule: make the hole three times the height of the bulb. What will happen if it is too near the top? What if too far down? Why?

2. Distance apart—depends upon size of bulb. Often bulbs have better flowers when they are close together. Why?
3. Procedure—dig a hole with a trowel or dibber and insert the bulb, putting a little sand if on a lawn or if the garden soil is not well drained. Do not screw the bulb into the ground. Why not? Pack in the soil tightly around it. Why? When cold weather approaches cover the bulb with a 6-inch litter or mulch of leaves or straw in order to keep the temperature of the ground as nearly as possible the same.
4. After-treatment—in the spring when the weather becomes warmer, remove the litter gradually. Why? Let the bulbs remain in the ground after flowering until their leaves die down. Why? Then remove them, cut off the leaves and roots, being careful to injure neither the tip nor the crown, and dry them in an airy place. When they are dry and clean, pack them away where the air can get to them, but where they will be protected from mice. If bulbs must be removed immediately after flowering they may be "heeled in" i. e., placed on their sides under a shed with their roots well covered with soil. For best results garden bulbs should be changed each year. In the grass they may remain for three years or more. Narcissus bulbs will "naturalize" in grass.

B. Indoors.

1. Soil.
   a. Depth—nearer the top than when outdoors. Why? Some large narcissus bulbs are planted with their tips protruding.
   b. Distance apart—nearer than when outdoors.
   c. Procedure—choose an earthenware crock of a size deep enough to accommodate the root growth and to allow an inch or so for drainage material. This may be moss, charcoal or bits of broken pots. Soak the pot in water, put in the drainage material, and upon it place a little earth. Then hold the bulb in position with one hand and fill in and pack down the soil with the other hand. When the bulb is just covered, the soil should be about half an inch below the top of the pot. Why? The pot (unless the plant is tender) should be placed in a cold dark place. A cellar or attic of this sort will serve if the bulbs are

protected from mice and are watered at infrequent intervals; but the best place is a trench outdoors. This should be 1 foot deep and should have 3 inches of ashes in the bottom to keep out worms. Pots placed here should be covered and packed with soil, although they may have straw over their tops to prevent the dirt from filling them up. Straw should be put over the trench in order that the ground may not be frozen solidly when the time comes to remove the pots. In from six to eight weeks, according to the kind of bulbs, the pots may be removed and brought into a cool place in the house. When they are accustomed to this they may be placed in a warmer temperature. Forty degrees is best for root-growth, 50° for shoots and 60° for flowers. Forcing is done with a higher temperature. By bringing bulbs into the house at different times a succession of flowers may be obtained. Freesias should be kept in the light from the first and hyacinths must have dark paper cones placed over them to induce leaf growth. Hyacinths should not be forced before February.

d. After-treatment—the bulbs should be kept in the sun and watered until the leaves die down. Then they should be treated in the same way as garden bulbs. Forced bulbs seldom produce flowers the second year, but if planted for a year or two in a garden may be again brought into the house.

2. Water—for this kind of culture special vases are used which allow the bulb to remain for the most part in the air. Only the crown touches the water, which should contain charcoal in order to keep it pure. In the case of Chinese lilies (a kind of narcissus), the bulbs are grouped in a dish and are propped up with pebbles. Paper-white narcissus and Soleil d' Or may be used in the same way. The Chinese lilies may be kept in the light from the first, but other bulbs should be put in a cool dark place until their roots are long enough to touch the bottom of the glass. Then they should be brought gradually into bright light and treated like potted bulbs. The supply of water should be removed from time to time.

V. Cost of bulbs, bowls, etc.—for this consult a bulb catalog on the small table in the botany laboratory.

A Succession of Flowers in Winter and Spring by the Use of Spring Flowering Bulbs

GRANT SMITH.

The following pages set forth plans which have been tried and proven by the writer and his students whereby the schools may have a succession of blooming plants with relatively and actually a small expenditure of money, time and trouble. The facts concerned are not profound, neither are the methods of bulb culture difficult; but it is safe to say that the majority of teachers have not yet learned how very easy it is to have a continuous succession of blossoms, not alone in rooms into which the sunlight enters but also in rooms receiving only north light. There are some important general facts, the understanding of which will make the management of bulbs intelligent:

1. Spring flowering bulbs are always listed in the autumn catalogues of the dealers (but the summer and autumn flowering bulbs are listed in the spring catalogues). The dealers who advertise in the papers and magazines devoted to homes and gardens are very willing to send catalogues gratis, on request. Because many of the spring flowering bulbs are made to bloom indoors by some system of "forcing," they are sometimes called winter bulbs.

2. Spring flowering bulbs are not propagated extensively in America for profit (as is the case with the other sorts), but are practically all imported from Europe, especially from Holland. Shipments are made in summer, and the bulbs begin to appear on the counters of the retail dealers the latter part of August, though they may be ordered from New York earlier. Naturally, the earlier varieties are put on sale first.

3. It is very important to remember that the sooner the bulbs are purchased and either planted or put where they will not deteriorate the better the blooms will be. This is particularly true of freesias and the Chinese sacred lily (a kind of narcissus). Cool, dry air is needed for most bulbs, and it is a good plan to put all, except those which are to be planted promptly, into a box of dry sand set in the basement. Miss June Rowe, a Chicago teacher, informed the writer that she stores bulbs successfully in the schoolroom closet by putting them into pasteboard cracker boxes which are lined with paraffin paper. Kept in some such way the bulbs are not reached by currents of dry air and neither do they mold. It is seldom worth while to buy members of the

genus narcissus (narcissi, jonquils, daffodils and Chinese sacred lily) after the first of January, for they are likely to be spongy later; but tulips, for example, are later in maturing and frequently remain firm and hard until February.

Do not buy spongy or unhealthy bulbs; the latter are more often found in small-bulb varieties (crocus, squills, snowdrops, glory-of-the-snow) for the reason that small bulbs are the more difficult for growers and dealers to inspect for signs of disease.

It is generally better to buy named varieties than mixtures, though some of the advertised mixtures have proven excellent. But large size bulbs of the old, standard varieties are so very cheap and fine that they answer every essential purpose of bulb culture in school. Furthermore, prices by the hundred and upward are more favorable than by the dozen, and most dealers sell twenty-five bulbs at the one hundred rate.

4. It may be helpful to refer to the fact that not all these "vegetative" parts by which plants are propagated are strictly bulbs. For example, squills grow from a small, solid bulb called a corm; and the caladium (elephant's ear), which is a summer bulb, has a gigantic corm. The lily-of-the-valley, which the florists speak of as a "pip," is an example of underground stem, or rootstalk. Tubers, like the Madeira vine of the summer time, are also listed with the bulbs; and peonies have fleshy roots. All these plants are spoken of as bulbous.

5. A brief consideration of some of the peculiarities of the life history of these plants is necessary. In respect to their ability to live out of doors in the northern states either all or part of the winter, bulbous plants are listed as hardy, half-hardy and tender. The Chinese sacred lily and paper-white narcissus, for example, cannot endure freezing; but tulips, hyacinths, crocuses, squills, jonquils, daffodils and *narcissus poeticus* are thoroughly hardy out of doors, even though they must be protected from alternate freezing and thawing when grown indoors.*

Under natural conditions these hardy plants live underground all winter, during which time, when the ground is not actually frozen, they are gradually developing a copious root system and thus making ready to send up a vigorous growth of leaves and flower stalks very quickly in spring. It has long been their habit, from their dark beds, to push their leaves and flowers up through

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*Grant Smith, "Improvised Devices for the Protection of Plants in School," Nature Study Leaflet, No. 7, 1912, Chicago Normal School Press.

a thick layer of soil and dead leaves, and they are aided to do this because of physiological facts which we refer to but do not explain when we say that in darkness or in dim light green plants grow tall and spindling, but in stronger light they grow shorter and sturdier. *This period in the dark is necessary to the perfect development of many spring flowering bulbs*, especially if an attempt be made to force them into bloom before their normal time; others can be made to bloom with fair success without initial darkness, the more so if they are allowed time to mature thoroughly before being potted; some bulbs do not require darkness, though they do well when it is provided; and finally, freesias are examples of winter bulbs which reach perfection only if started by the end of September in dim light, at schoolroom temperature, and placed later in the sunny window. The various members of the genus *narcissus* are examples of the second group; and hyacinths, tulips, crocus, and squills are of the first class.

After blossom and seed time have passed, the plant stores its underground parts with food for the next season, if the conditions of growth permit it; and then the parts above ground die and disappear. Because of the possession of this large food supply, it happens that most spring bulbs do not need any light the next season for the mere task of producing flowers, though of course the light *is* needed if the bulbs are to be able ever to store food again. That is, once stored with food, as the bulbs ought to be when offered for sale, they will produce perfect flowers when growing in complete darkness, the only difference being that the leaves will not be green until they have been a few days in the light. An interesting example of this fact is the "Byzantine Wonder Lily," now being advertised extensively by florists as needing neither light nor water. This "lily" is not a fake (as is the Japanese "air" plant) and so early is it that it frequently blossoms in the packing cases *en route* to America.

Thus, all the spring flowering bulbs mentioned, excepting freesias, are especially adapted for blooming in rooms which have only diffuse or north light. Here they will turn green and blossom perfectly, but the bulbs will be worthless for another season's blooming in the house, for they will not be able to store enough food for another cycle of growth. Nevertheless, if the bulbs forced to bloom indoors are hardy, they may be left in the pots until October, when they may be planted in beds out of doors; but in the latter event it is well to cut the flower stalks out the next spring as soon as they appear in order to let all the

energy of the plants be directed toward food storage. Florists do not usually take the trouble thereafter to grow bulbs which they have once forced for cut flowers, and many are quite willing to give them away to teachers about the time of the Easter trade, knowing that the growing of bulbs by school children will ultimately greatly increase the demand both for cut flowers and the best imported bulbs.

The time or earliness of bloom of the spring bulbs, after planting depends (a) upon whether or not the species in question are naturally late or early, (b) upon the temperature in which the bulbs are set to grow after the potting, (c) the vigor of the individual bulb, and (d) the length of time allowed for the bulb to mature before planting. The earliness of the Byzantine wonder-lily has been mentioned; and examples of the other extreme are the tulips and hyacinths, which florists have great difficulty in bringing to bloom on long stems by Christmas, though the stems are long when the bulbs are allowed their natural period of growth. As to the temperature, bulbs which bloom successfully when started in the window can endure the room temperature (except that they should not be subjected to icy drafts from the open windows); but the best temperature at first is 55° Fahr., and the bulbs develop the more rapidly in proportion as the temperature is made higher.

Planting Plans for a Succession of Blooms.

By taking advantage of the facts hinted at in some of the preceding paragraphs, a practical plan may be devised for having plants in blossom continuously during the winter and spring.

1. Early flowering varieties may be potted at intervals of a week or two, care being taken to keep the main supply cool and dry. The Chinese sacred lily and the paper-white narcissus can be depended upon to give satisfactory results; but being early they will not last until spring unless the bulbs are kept in cold storage; and this is the plan actually followed in the case of lily-of-the-valley, which can now be had as cut flowers every month in the year.

2. The bulbs may all be potted at the same time, (a) some of the preparations being started in the schoolroom and the others placed where for a time they will keep (b) less warm, (c) cool, (d) cold, and (e) frozen, respectively. For the last class hardy bulbs are necessary; and for the first ones early varieties.

3. Bulbs of different varieties may be selected, such that some will bloom early, some less early, and some late; but the plant-

ing would all be done at one time, and the same growing conditions would be arranged for each.

4. Some convenient combination of either two or all of the preceding plans may be made. In this way before pupils leave the elementary schools, they can become thoroughly familiar with the essentials of the technique of bulb-forcing for winter bloom under the most difficult conditions, such as modern dwellings present.

Where Spring Bulbs May Be Started.

A view of the many possibilities in the use of spring bulbs which are unlike in hardiness and time of bloom and which may be started under varying conditions is readily had from the following outline:

(A). Some May Be Grown in the House All of the Time.

I. Of this class some may be kept in the light from the first, in rooms supplied either with diffuse or direct sunlight, and placed either in the windows or in some convenient corner.

Cultivation in Water.—Deep bowls are best. Any members of the genus narcissus; but not hyacinths, tulips, crocus. Pebbles (or crushed stone, small pieces of hard coal, or of charcoal) placed around and over the bulbs will keep them from floating and their roots from breaking; but if several are grown in a large bowl they will mutually support each other. Water culture is excellent for the primary grades and the kindergarten, because the children can watch the development of the entire plant. Some florists recommend for the Chinese sacred lily, tepid water (preferably soft) changed frequently.

Cultivation in Some Stabler Medium.—Soil, sphagnum moss or cocoa fibre, obtained from the florist, may be used, *but pure sand should never be used*, because it will not retain water well enough. The moss or fibre are useful for comparison, and they have the advantage of being clean. If it be thought desirable to furnish mineral food, either to these media or to the soil, Sachs' solution or some commercial preparation like Bowker's may be used.

It is convenient here to refer to results which Professor Cole's students secured by planting early bulbs late in the winter after they had thoroughly matured.* "Such a planting on Febru-

*A. H. Cole, "The Best Bulbs for Winter Flowering in the School Room," *The Educational Bi-Monthly*, Vol. VI, No. 1, October, 1911, pp. 66-69.

ary 28th, in soil in a self-watering flower box that stood about eight feet from the nearest window, resulted in blossoms in short space of seventeen days; and a similar planting on March 21st gave blossoms in twenty-one days.

II. Others of this class may be put in a *dark, cool place for six weeks or more,* preferably at 55° Fahr. but not over 65°. A dark closet in the basement is a good place. The time in the dark must depend on the temperature, the earliness of the bulbs and their maturity. Hyacinths, because of the schoolroom conditions to come later, need to stay in the dark until the entire flower-mass of the flower stalk is out of the ground; and the tulip buds also should show. Members of the genus *narcissus* may remain in the dark until their leaves are six or eight inches high. After this period in the dark the plants, which have been started either (1) in water or (2) in soil, cocoa fibre or moss, should be brought into the school room and set in *dim light* for several days or *until the leaves turn green,* after which they may be set in the windows, if it is convenient.

The following table shows the results of one such set of plantings which the writer's students made last winter. As the weather was unusually cold a part of the time, the temperature often fell to freezing and below; hence the development was quite slow:

Name.	Placed in dark.	Dim light.	Blossomed.
Paper-white narcissus	Nov. 27	Jan. 31	Feb. 13
Double daffodils.....	Nov. 27	Feb. 5	Mar. 7
Narcissus poeticus ornatus.....	Nov. 27	Feb. 6	Mar. 7-11
Single jonquils.....	Oct. 31	Jan. 31	Mar. 11

(B). Some Bulbs May Be Planted in Pots and Buried Out of Doors for Five or Six Weeks.

After this length of time two or three pots at a time may be dug up and placed first in dim light and then in full light, as already indicated. The last of the pots may be left out until the frost leaves the ground in the spring.

This method may be used with all sorts of hardy bulbs and

is the one which florists follow. The pots of bulbs are merely buried in trenches about six inches under ground, but the trenches should have cinders in the bottom if the ground has poor drainage. For earliest bloom the bulbs would be buried as soon as they can be purchased, but for later results the process would be repeated at intervals until the end of November, or until the ground freezes. Different plans which have been worked out by students, by burying the potted bulbs, are as follows:

I. Buried on the sunny side of an inner court, November 27th; pots dug up and brought into dim light April 4; the crocuses and squills began to blossom April 8th; the trumpet-major and Van Sion daffodils and *Narcissus poeticus ornatus* began to blossom April 12th. Immediately after the pots were buried, the ground was covered over with several inches of coarse litter to serve as a mulch. Thus the cold weather did not keep the bulbs dormant.

II. On the south side of a house, mulching was put on early.

III. In the open ground, reached by the sun's rays all day long, no mulch was used.

IV. On the north side of a house, where the ground did not thaw out as early in spring as did the sunny ground, no mulch was used.

V. On the north side of a house, and *after the ground had frozen hard in December*, mulch was scattered over the ground. The mulch kept the ground frozen still longer in the spring, and the bulbs blossomed in the house the last week in May.

How To Pot Bulbs.

Directions for potting bulbs are always included in the bulb catalogues, though modification to suit school conditions must sometimes be made. At the Chicago Teachers' College excellent results have come from the use of the authorized self-watering metal window boxes, and these devices may be improvised in many ways as illustrated in a current *Nature Study Leaflet*.*

1. The number of bulbs per pot must depend on the size of the bulbs and of the pots, but not more than the following numbers should be used in a six inch pot: five tulips, six crocuses, three narcissi, three hyacinths.

*Grant Smith, "Improved Self-Watering Devises for Home and School," *Nature Study Leaflet*, No. 6, 1912, Illustrated. Chicago Normal School Press.

2. Good drainage must be provided in the ordinary pot; for example, by placing a piece of broken flower pot in an arching position over the hole and filling in an inch of coarse material like crushed rock, gravel, etc. Then an inch of coarse soil may be put in, and then the ordinary soil to within a half inch of the top after the bulbs are in place.

3. The soil should be light and rich, and it may be purchased from the florist; but it is more educative for the children to mix it themselves—three parts loam, one part sand, and one of leaf mold. If the loam is the clay type, two parts of it and an extra one of sand is advisable; but if the loam is sandy, four parts of it and one of leaf mold is best. The leaf mold causes the soil to hold water. It may be purchased from the florist and should not be unduly adulterated with unrotted leaves or bark. Grassy sods of loam may be put into a pile to rot and used later without any additional material. However, many florists in the autumn add a large double handful of scraped horn to every bushel of their best loam.

4. The bulbs should be set in the soil so as to project above it about a third of their length, except in the case of very small bulbs which are to be watered from above, in which case only the top should project above the soil. It is well to place a tablespoonful of sand under each bulb to improve the drainage and prevent decay. Press the bulbs firmly down in place and press the soil around them, but do not let the children pat the soil down all over the surface into a pasty layer as they seem inclined to do so frequently.

5. When the bulbs have been potted, the entire soil in the pot should be thoroughly soaked with water; but thereafter the soil should be kept nicely *moist* until the buds appear, lest the bulbs mold. Then, however, use water abundantly, otherwise the buds will blight.

Sudden Changes in Temperature.

The blighting of the buds and unsatisfactory results generally come as often from allowing sudden drafts of icy air to blow over plants placed in the windows as from poor bulbs or improper watering. It is not so harmful for the rooms to get moderately cold gradually, at night, but sudden drafts from the window are fatal. These plants endure a position near a steam radiator much better, and since they do not need the sunshine in order to produce flowers once, it is best to set the plants where they cannot be reached by sudden drafts of cold air. It should

be said, too, that, after the bulbs once start indoors, they cannot endure sudden alternate thawing and freezing thereafter. Reference has already been made to means of protecting schoolroom plants in winter.

Chicago Teachers' College.

A Feathered Policeman

HARRIET WILLIAMS MYERS.

The mockingbirds are regular tenants of ours, being always about and oftentimes acting as if they, rather than we, owned the place. These gray songsters are birds of many moods, singing and scolding almost in the same breath.

On one occasion the actions of one of these birds were very amusing to those who witnessed them, and, I believe, were considered a good joke by the bird itself.

It was winter time and the bird table was, as usual, supplied with food. A large flock of winter visitants, the white-crowned sparrows, were swarming over the board. These sparrows are always hungry and, being rather overbearing in actions, often keep the Audubon warblers and other timid birds away more than I like. But there came a day when they met their just deserts.

It was their habit not only to eat from the table but often

WHITE CROWNED SPARROW AT THE FOOD TABLE.

Mocking Bird at the Table; White Crowned Sparrow in Background.

one or more would take a large piece of bread and fly to the ground, where several other birds would give chase and a noisy scramble would ensue. On this afternoon the birds were, as usual, in a large flock about the bird table. No sooner had one of them alighted and begun to feed than there swooped down among them, scattering them in all directions, a mischievous mockingbird. Now, though the sparrows drive away other birds, they make no resistance when the mocker appears. He is monarch of all he surveys. After standing in the very center of the table for a minute, without even a pretense of eating, with a flirt of his long expressive tail, he flew to a nearby fence, his back toward the bird table. Very soon the sparrows began to assemble again and their cheerful, happy notes filled the air. But though Mr. Mocker's back was turned, his eye was upon them. He waited until they were reassured and eating, and then, with a quick turn and flight, he was again in their midst. Again there was a scattering of small birds. This program was kept up for half an hour, and those who observed it could not help but feel that the mockingbird thought it a good joke to scare these smaller birds and that he acted as feathered policeman just for the fun of it.

Los Angeles, Calif.

How To Grow Bulbs for the Schoolroom

H. D. Hemenway.

Few plants that can be successfully grown in the school room are as satisfactory or as easy to grow as some bulbs. A continuous succession of bloom may be had by properly handling them. If desired, the children may do the work of planting and caring for them. It is easy to show the children that bulbs are composed of thick fleshy leaves by cutting two in halves, one vertically, the other horizontally, and exposing the cut faces to the sun for a few days until partly dried out. Another way is to remove the outer covering and then the thickened leaves one at a time. When we understand that these thickened compressed leaves are store houses for food, we better understand how we may get good results with bulbs by simply supplying sufficient water. The water with the supply of air, both at the leaves and roots, enables the bulb to quickly grow and bloom.

For successful bulb growing it is important to get a good root development before the tops have started. While poorly handled bulbs may give fair results, proper planting and care means greater success.

Only good strong healthy bulbs should be purchased. For winter blooming they should be planted early in a mixture of moist soil, composed of soil and decayed leaves, to which a generous sprinkling of sand has been added. In the absence of a compost pile, mix equal parts of available soil and soil gathered from a hollow in a woods composed largely of the decayed leaves of deciduous trees. In a city the leaf mold may be purchased of the florist. Drainage composed of clinkers, small stones or broken pots should be placed in the bottom of the pot. Never press the bulbs into a pot filled with soil. If the soil directly under the bulb is hard, it may be forced out of the pot by the roots. Press the soil firmly over the top, barely covering the nose of the bulb. When planted, water thoroughly and put the pots or boxes of bulbs in a cool, moist, well-drained place. A cold frame is best, but a cool cellar or shed will do. Fill the soil two inches over the pots or boxes and add leaves or straw to prevent freezing as the weather becomes colder. Cover the cold frame with board shutters. After eight weeks a few of the earliest bulbs may be taken to the school room. Others may be taken every week or ten days so as to give continuous bloom. For best results do not remove the bulbs until the roots show through the

pots. Getting good root development before the top starts is essential to success. This is the object of keeping them in a cool moist place before "forcing" begins. This will take from eight to sixteen weeks.

For early bloom, before Christmas use early bulbs as white Roman hyacinths. It is better to pot these in September and bring them into the school room just after Thanksgiving. If a moist cellar is used it may not be necessary to cover the pots with soil. However, bulbs covered two inches with moist soil require no watering and usually mature better roots as the moisture and temperature is more uniform. In the dry air of the school room the rapidly unfolding flowers will require much water and should never be allowed to dry up; on the other hand, the soil will become "sour" if kept saturated in standing water. No fertilizer will be required; a light, porous, well mixed, spongy soil is all that is needed. The most satisfactory bulbs for the school room, considering the dry atmosphere, low temperature nights and week ends, and unavoidable draughts, are hyacinths, narcissus, jonquils and crocus.

The earliest bulbs are white Roman hyacinths. These are followed by pink and blue Roman, white Italian and Dutch hyacinths. The yellow crocuses are earliest. Common trumpet narcissus and jonquils come about the same as Dutch hyacinths. They should be kept cool about three months. Freesias, if grown, should be started in the school room from the first. Many other bulbs are grown, but are less likely to succeed.

Nature Study and Hygiene

F. M. Gregg.

II. A Study of Teeth and Their Care.

Recent examination of the school children of New York City, ten years of age and under, disclosed 60 per cent of them having defective teeth. Similar studies in Boston gave 64 per cent of tooth-affected children, while in Brooklyn the percentage rose to 77. If the reader is not fully informed as to the undesirable results that attend defective teeth he should read some such account of the matter as is found in Allen's "Civics and Health." The matter is of such grave importance for children that the subject may well be taken up in fourth and fifth grades, not only because of what the schools may be able to do directly

for the pupils, but because of what they may be able to accomplish in supplementing the efforts of the home. An additional justification for the study of teeth in the fourth or fifth grade lies in the fact that chidren in these grades are in the years of second dentition and this furnishes adequate motivation.

The studies here reported are quite as they were given to three successive classes of children in the training school of the Peru (Nebr.) State Normal School. At the end of the studies not a few of the children, having retired at night without first brushing the teeth, would rise on recalling this neglect and go through the brushing operation. This happened a number of times in the case of a little girl in the writer's own home.

A. Preliminary Studies.

It would be quite advantageous, not only for the study of teeth, but also for other hygienic studies, if some inquiry could be made, in the nature study way, of certain conditions and results of germ activity. A culture medium such as is described on page 274, Vol. VII (1911) of The Nature-Study Review, could well be employed in a gross study of germs. Touching one of these gelatin perparations with a bit of decaying fruit and another with scrapings from the teeth will yield readily observable colonies of germs in two or three days, particularly if they (especially the latter) be kept at 90 to 95 degrees F. The suitable germ studies will bring out the fact that germs thrive where there is food, and where it is warm, moist, and dark.

B. The Nature-Study Approach.

(1). *Number and Kinds of Teeth.*

(a). Instead of sending the pupils to the books to find out in the purely bookish way the number of teeth at the various stages of development, assign as a study to be reported on at the next recitation hour the number of teeth each pupil may find in his own and his larger and smaller playmates' mouths.

(b). With this same assignment there should go one requiring the pupil to study, with the aid of a mirror (pocket mirrors such as are often given away for advertising purposes serve admirably) his own teeth so as to be able to describe their appearance and differences.

(c). At the class hour the pupils report their discoveries. If the teacher desires to give the technical names for the various groups of teeth, the necessary motivation may be secured by asking the pupils if they would like to be able to talk to the doctor.

priest, or pastor in their language, about teeth when these men pay a visit to their homes. The functions of the different groups of teeth may be inductively studied with profit by following the suggestion of Mr. Dearness in the December, 1911, number of THE NATURE-STUDY REVIEW (p. 271), namely, supplying each member of the class with grains of wheat, pieces of thread and strips of bread, and noting the uses and groups of teeth employed in dealing with these materials.

(d). As a further study, now that the names of the teeth are known, the pupils can be directed to find out, so far as they can, when their own and their playmates' various second teeth came in. At the class hour, a tabulation can be made on the blackboard, of all the results reported. There will be variation, of course, but the final table should average up about as follows for the upper jaw:

Two middle incisors—7 years.
Two lateral incisors—8 years.
Two canines, or cuspids—11 years.
Two first bicuspids—9 years.
Two second bicuspids—10 years.
Two first molars—6 years.
Two second molars—12 years.
Two third molars—17 to 45 years.

(2). *Structure of a Tooth.*

(a). The *parts* of a tooth can best be studied by providing the pupils with human teeth obtained from an obliging dentist. Indeed, it would not be difficult to get a full set of extracted teeth in fairly good condition and have a small hole drilled through them transversely so they could be strung on a wire in their proper order. After the parts of the teeth have been decided upon by the pupils, the terms crown, neck and fang may be supplied.

(b). The *structure* and *materials* of a tooth can be grossly studied from teeth that have been ground in transverse and longitudinal planes, and the names enamel, dentine and pulp cavity supplied.

C. HYGIENIC STUDIES.

(1). *Conditions and Effects of Decay.*

(a). Secure from the laboratory or the druggist some blue litmus paper, and, in the presence of the class demonstrate its use in discovering acid substances.

(b). Test the decayed spots on spoiled fruits, such as bananas, apples, etc., with litmus paper, and let the class report their conclusions from the effects observed.

(c). Now provide each member of the class with a piece of blue litmus paper and give directions that each shall put some scrapings from his own teeth on the litmus paper. Note the effect after a few minutes, and draw his own conclusion in the light of the preceding experiments.

(d). When the reports come in of the effect of the tooth-scrapings on litmus paper, recall with the class the relation of germs to decay and the conditions that favor growth of germs.

(e). At this same class period apply dilute hydrochloric acid to one of the teeth previously studied, and permit each member of the class to see the little bubbles that arise from the tooth. Watch the acid is "eating" the tooth.

(f). Now connect up this phenomenon with the acid condition of tooth-scrapings and secure the proper inference as to the cause of decay, namely, the action on the teeth of acids developed by germs of decay in foods left in the mouth and between teeth. Explain that sugars, candy, and starchy foods most quickly yield these acids that eat teeth.

(g). The matter of using the teeth to crack nuts, etc., may here be taken up, and the reasons made clear why it is especially desirable to preserve the enamel of teeth intact.

(2). *Some Hygienic Conclusions.*

(a). Out of all these studies readily come the conclusions as to why teeth decay. The point especially to be emphasized is, of course, to let the pupils reach these conclusions themselves so far as possible. Once the conclusions are definitely formulated, they should be carefully recorded by the pupils in their note book on nature study and hygiene.

(b). Pupils may now draw upon observation and experience for undesirable effects of decaying teeth, such as personal pain, expense of dentistry, and the social effects—bad breath and unsightly mouths. As was emphasized last month, the social appeal is the one most likely to be effective in securing proper dental habits.

(c). The methods for keeping teeth clean and especially the best times of day for the cleaning process can now be supplied in part by the pupils and in part by the teacher. It is particularly important to ask why the teeth should be cleaned just before retiring, and why it is even more important for children to be

particular in these matters than for adults. These studies should also make it clear why the eating of candies and sweets, generally between meals, is unwise.

(3). *Some Follow-Up Studies.*

(a). After the work has been covered in this nature study way, the books may now be turned to for review and for any additional information. The ground can be covered rapidly, and will be covered eagerly and understandingly.

(b). The great purpose of the study of hygiene in the grades is the development of hygienic habits, and to this end the pupils must be asked for many days, "Who of us did not forget to clean our teeth yesterday and last night?"

Editorial

Economic efficiency may be called the first social demand. The individual must first earn his living, then he may live his life; and this is as true of the race as it is of the individual. The basis of the best civilization has ever been the act of winning a livelihood from a somewhat reluctant nature. Man's constant task has been the study of nature in order to subjugate her, for he has only discovered her laws that he might utilize her forces. The eight-hour day is made possible for the working man because the mighty powers stored in the coal, rampant in the winds, surging in the rivers, have been yoked to his task. They have supplanted human brawn and freed the laborer from a slavery that demanded all his waking hours in return for a bare subsistence. The world's wealth has been immeasurably increased by this same study of nature and the utilization of her forces. Gladstone estimated that in the first half century after the application of the steam engine to man's labors, the wealth of the world was doubled—that is, as much wealth was added in fifty years as had been accumulated in four thousand. Now, the world's store of wealth doubles in a decade.

It is one glory of the student of nature that he has been able thus to increase the world's wealth and decrease the necessary hours of toil; and since man is consciously aiming to achieve these ends, progress is now much more rapid. By careful breeding, in accordance with the recently formulated laws of heredity, varieties of corn have been produced adapted particularly to Illinois conditions, and the corn production of the state thereby increased forty-five million bushels in a decade. The milk tests devised by Professor Babcock of the University of Wisconsin

and put into the farmers' hands, largely through the efforts of the schools, are saving nearly a million dollars a year to the dairy men of that state.

By means of the school garden, elementary agriculture, common-place physics and chemistry and practical sanitation, nature study in the schools may help mightily to increase the economic efficiency of the pupils, and it does well to ally itself with these broad economic movements. The average corn production in North Carolina, for instance, was 18.4 bushels per acre last year. In that state, the same year, two hundred and sixty-four boys, guided by careful instruction, averaged on one acre of ground 67.69 bushels, and one of them produced 196.5 bushels of dry corn. If the farmers of the state could have done as well as the boys, the corn production of this one state would have been increased a hundred million dollars worth. With such examples of the possibilities of production scattered throughout the state, the farmer is not long going to be content with a niggardly eighteen bushels per acre. Such nature study instruction is eminently worth while.

Heredity is conservative. The old structures, the old reactions are usually reproduced with faithfulness. This is true not alone of physical inheritance, but of that social heritage which comes to us from the past. The customs, habits and opinions of our fathers are not easily changed. It is a privilege of the intelligent, alert school-teacher to keep in touch with the worthwhile things that are new and to champion them in his community, for the school is the natural organ for the social transmission of valuable acquired characters. How the schools have aided in the acquisition of our new attitude toward tuberculosis! The dull submission to the terrors of the great plague is changing to defiant hopefulness. Vice and poverty must similarly give way to righteousness and comfort. The nature teacher has large opportunity to mold public opinion in the practical matters and modify inefficient and unproductive habits and customs.

"Well, Casey," said Wagley, "I hear the crops are so poor in Ireland that they can't even afford to keep scarecrows there."

"The truth's not in ye!" replied Casey.

"Oh, come now, you know very well they haven't any scarecrows there."

"Haven't we tho? Shure, many's the time I've gathered the eggs o' them."

—PHILADELPHIA PRESS.

News and Notes

A Nature-Study Bungalow.—The class of 1912 of Normal School No. 1, Washington, D. C., has done something rather unique in nature study lines. This class under the leadership of Miss Susan B. Sipe, teacher of science in the normal school, made frequent trips up the Potomac River to Great Falls, Cabin John Bridge, Glen Echo and other picturesque places in this mecca of the naturalist. The class became very enthusiastic in its nature study work, and when the question came up of leaving something to the Normal School as a reminder of the class, some one suggested a nature study bungalow "up the river." The suggestion "took." Committees were set to work, a long-time lease was secured on a wild bit of land above the river bank near Glen Echo and a bungalow costing $400 was erected. This bungalow and the adjoining land under lease are to remain under the control of the class of 1912 until that class as an organization is reduced to one-fourth its present number, after which they pass over to the Normal School. In the meantime the other senior classes in the Normal School are to have the use of the bungalow and grounds under regulations made by the Normal School, and may thus enjoy all the privileges of the institution except that of ownership.—D. J. Crosby.

We shall have some articles on nature study with common rocks and minerals from W. A. Tarr of the University of Missouri, in early issues of the Review.

We expect to use a number of the colored plates this year similar to the frontispiece in the September number and in this issue. Possibly one will accompany each number; certainly, if the feature brings us enough substantial appreciation to warrant the added expense.

The annual election of the society will occur in December, at which time a president, five vice-presidents, five directors and the secretary-treasurer are to be elected. B. M. Davis is now president. The vice presidents are M. A. Bigelow, Anna B. Comstock, S. Coulter, D. J. Crosby, F. L. Holtz. The directors whose terms expire this year are E. B. Babcock, Otis W. Caldwell, Anna B. Comstock, J. Dearness, Ruth Marshall. The constitu-

tion (Article IV) provides: "The Council shall make nominations for all offices and publish them in the official journal before November fifteenth of each year. Members and fellows shall have the right to suggest nominations by mail, and any name thus receiving at least twenty-five votes before October fifteenth shall be published with the nominations by the Council." Any members having nominations to make will please send the names to the editor who is also the secretary-treasurer.

NATURE-STUDY ARTICLES IN RECENT MAGAZINES.

"Sunstorms and the Earth," E. Walter Maunder, *Harper's*, September.

"The Motion of the Fixed Stars," Benjamin Boss, *Harper's* August.

"The Last Frontier" (helpful to geography teachers), E. Alexander Powell, *Scribner's*, September.

"My Friend the Ruby-Throat," Katherine E. Dolbear; "Entomological," Robert M. Gay, *Atlantic*, August.

"The Doom of the Lion in Africa," Cyrus C. Adams, *Review of Reviews*, August.

"Annuals for Winter Bloom Indoors," *Garden Magazine*, August.

"Notes about Ants and Their Resemblance to Man," Wm. Morton Wheeler, *Nat'l Geog. Mag.*, August.

"The Retreat of the Birds," Hamilton W. Laing, *Outing*, July.

"In the Noon of Science," John Burroughs; "Who are the Japanese" (for geography teachers), Arthur May Knapp, *Atlantic*, September.

—DELIA I. GRIFFIN.

C. W. Finley, graduate student in natural science in the School of Education, the University of Chicago, has accepted position as head of department of biology at the State Normal School at Macomb, Ill.

A Nature-Study Club was recently organized at Grand Rapids, Mich., thanks to the efforts of Miss Ora May Carrel. Details of the organization will be given in a later issue

Book Reviews

Handbook of Birds of Eastern North America, revised edition. Frank M. Chapman. Pp. xxix-530. D. Appleton & Co. Cloth, $3.50; leather, $4.00.

Bird students have been anticipating with pleasure the appearance of this revised edition and no disappointment is felt in its realization. Much new material has been added. In the preliminary chapters there is now a list of ornithological societies and magazines. The discussion of bird distribution is amplified, and a valuable zonal map of North America is added. The treatment of bird migration is extended, and a number of outline maps make the subject more lucid. Much new material is included in the treatment of the plumage and the significance of color. These introductory chapters of a hundred and seventeen pages are exceedingly interesting reading, and make about the best discussion of bird problems in small compass that is available. The keys and descriptions of species make up the rest of the book. Throughout, these have been brought up to date. Twenty-four full page plates, mostly in color, in addition to the many figures, add to the value of the work. Extensive literature references are added to the preliminary chapters, and a bibliographical appendix supplements the body of the book.

The Flight of Birds. F. W. Headley, Pp. x+163. Witherby & Co., London. Five shillings. Chas. Scribner's Sons, American agents.

This book discusses in a very entertaining way the problem of bird flight, considering the animal as an efficient flying machine. Chapter I, Gliding; III, Motive Power; V, Steering; VII, The Machinery of Flight; VIII, Varieties of Wing and of Flight; IX, Pace and Last, are some of the eleven chapter headings which give an idea of the scope of the work. There are sixteen full-page plates and twenty-six figures in the text. The Machinery of Flight, chapter VII, is an interesting discussion of the bird's structure, with especial reference to its bearing on flight. The diagrams make clear the relations of bones, muscles, tendons and feathers to produce the needed mechanism. Many of the photographic reproductions of the birds in flight catch them in attitudes of wing and body that are strange indeed. This photographic analysis of the various stages of flight make it clear as to how much the eye of the observer misses. The book is a

valuable addition to the study of the bird, and has practical interest, too, for the aviator. One only regrets that these excellent and cheap English books are not available to American students without the additional cost of the tariff.

Butterfly and Moth Book. Ellen Robertson Miller. Pp. xviii +249. Chas. Scribner's Sons. $1.50.

The author tells us in her preface that "My interest in moths and butterflies was awakened some ten years ago while at the farm on which we spent our summers. The big flower garden and the old orchard served free luncheons to these insects, and judging by numbers, they appreciated the treats offered. The following year I found that the children of the neighborhood, and even the children's parents, were taking an interest in the insects which we reared." It was in response to a suggestion by some of the children that she began to write the stories of the "frail children of the air." The book, therefore, is the result of years of patient study. It is amply illustrated with scores of photographic reproductions and pen and ink sketches of the eggs, larvæ, moults, chrysalids and adults of various common moths and butterflies. The author's descriptions are clear, her interest evident, and her style simple. The book is a recital of personal experiences in finding, rearing and caring for these wonderful creatures. It has in it the spirit of enthusiasm of a nature lover. Surely a boy or girl of high school age with a leaning toward insect collecting would appreciate the volume and be led by it to studies of his own.

Productive Farming. K. C. Davis. Pp. VIII+357. J. B. Lippincott Co.

Doctor Davis is professor of agronomy, New Jersey College of Agriculture. He says in his preface: "The ever-present memory of the boys and girls with whom the writer has associated as a schoolmate or as a teacher in the rural schools and graded schools has been an inspiration and help in preparing every lesson." This book is intended to suit the needs of the rural schools of all kinds and graded village and city schools, chiefly below high school rank.

Part I is on plant production, and includes chapters on the physiology of plants, plant improvement, soils, cropping and special crops, like alfalfa, corn, etc. Part II is on animal production, with horses, cattle, poultry management, bee-keeping, etc., as the topics treated. Animal products, sixteen pages, make Part III.

Farm Management, seven pages, constitutes Part IV. Part V is the appendix, with lists of reference books, experiment stations, tables, rules, formulas, etc.

Surely, if the farm boy of the present day acquires before high school age, all the information this book contains with the principles enunciated, we may promptly anticipate a progressive farming population. Without practical work the book would be largely meaningless. Accompanied by actual manipulation of the materials discussed, there is enough in the book to busy a school for several years, it seems. The book is a good one, however, but will be more serviceable to the rural child's father than to the boy himself. This is a fault common to texts of this class, and possibly a commendable one. Take, for instance, the chapter on Poultry Management. Here there is found condensed into fourteen pages the gist of the best practice in rearing chickens, feeding, housing and disposing of the product. A child might follow the directions and handle a small bunch of chickens successfully, but he would need to try it out to appreciate the suggestions. It would be dry reading to the boy without experience.

Some of the instruction is too brief to be serviceable. Thus, under Farm Accounts, single entry is disposed of summarily thus: "What is known as a single entry system is easy to understand and requires little time. When a calf is sold for cash, the entry is made on that date of the cash account, 'Calf sold, $10.00.'" In spite of the condensation the book will undoubtedly serve admirably in the hands of competent teachers.

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Vol. 8, No. 8
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VOL. 8 NOVEMBER, 1912. No. 8

Annual Meeting and Election of Officers

The fifth annual meeting of the American Nature Study Society will be held in Cleveland, Ohio, December 30th and 31st in connection with the meeting of the American Association for the Advancement of Science which occurs from December 30th to January 4th. Details of the program, etc., will be given in the December Issue.

The Council has made the nominations for officers to be elected at this meeting. All subscribers to this magazine are members of the Society and entitled to vote. If you are not to be in attendance at Cleveland, mail your ballot (printed opposite this page) to the Secretary, Elliot R. Downing, The University of Chicago, The School of Education, before Dec. 15, 1912. Seal the ballot in an envelope marked "For officers, 1912."

Foreword

The NATURE-STUDY REVIEW should serve a wider constituency. There are thousands of teachers and nature students who need just the practical suggestions and the inspiration which its pages afford. It is the only magazine which is devoting itself exclusively to outlining successful work in nature study for the grades and to discussions of the teaching of the subject.

Normal schools, superintendents and teachers would subscribe to it, we are convinced, if they knew more about it.

Our subscribers are in limited localities. In most states, for instance, the subscriptions come from three or four cities, where someone has become acquainted with the magazine and has stimulated local enthusiasm.

The Editor asks your hearty co-operation in increasing our membership and widening the influence of the society, and desires to call attention to the special offer made on the opposite page.

Editorial

The last editorial extolled the practical values of nature study. In this the adverse side of the shield will be displayed. Nature study aims at an ennobling, inspiring, healing companionship with nature as well as a commercial knowledge of nature. The moral uplift is the ultimate desire. We all appreciate with Whittier—

"How wearily the grind of toil goes on
Where love is wanting, how the eye and ear
And heart are starved amidst the plenitude
Of Nature.

* * * *

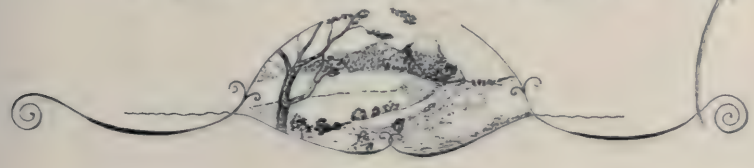
And, in sad keeping with the things about them,
Shrill querulous women, sour and sullen men,
Untidy, loveless, old before their time,
With scarce a human interest save their own
Monotonous round of small economies,
Or the poor scandal of the neighborhood;
Blind to the beauty everywhere revealed,
Treading the May flower with regardless feet;
For them the song sparrow and the bobolink
Sang not, nor winds made music in the leaves;
For them in vain October's holocaust
Burned gold and crimson, over all the hills,
The sacramental mystery of the woods."

Nature study aims to reveal the significance of the commonplace environment. The average school child is destined to spend its life among familiar things. The hills and valleys, the winding river, the flowers seen so often they remain unseen, the indifferent voices of field and woodland—these become mononotonously commonplace in the humdrum existence unless the teacher or some one with the breadth of outlook can put into them the fullness of meaning they really possess.

I go out into the fields and from the copse

of bushes yonder come the rippling cadences of a happy songster. "Hello, chewink," I can exclaim, for I recognize my little friend's voice and accent. I know just how he sits on that topmost swaying bough and how his little throat is swelling as the gladsome notes pour out on the pleasant air. I know how his mate looks, where their nest is, how their babies are fed and nurtured, when to expect his first cheery notes in the spring, when to hear him say his autumnal good-bye. And I have learned it all from behind the shelter of the thicket screen while my companion was snoring in his hammock after too copious a Sunday dinner. He does not know my feathered friend. To him he is "only a sparrow or something." He is weary of the life that is a deadening round of toil unrelieved by stimulating change. But here are sufficient problems presented by this one birdling to keep one's mind from wearisome monotony. Why is he so brilliantly colored, his mate dressed in somber tones? Why are their eggs speckled brown on a white ground while robin over yonder lays eggs of blue? Where does he go in the winter, how know his way and what led him to undertake, he and all his kind, these yearly pilgrimages?

I recognize the metallic blue of that swift-flying insect that is hurtling over the low bushes and grass nearby where we are sitting. My companion does not deign to notice him unless he comes too close, when he dodges to escape an ugly hornet. I know what he is hunting for there and when he rises bye-and-bye in widening circles, I catch sight of the spider held close below his body. I can



imagine the quick thrust of the poisoned dagger, the sudden paralysis of his prey, its seizure and the quick journey through the air to the insect's nest. I know what the rest of the story will likely be.

This little flower that we crush as we sit down is an acquaintance of mine. My companion picks a bunch, smells it with pleasure, puts it in his buttonhole and dismisses it with "pretty, isn't it " But I know what that spur is for, filled with nectar and why it has those delicate converging lines in its throat. I know the little gauzy winged visitor that it welcomes because it is such an important factor in its life.

To me the fields are full of voices. Each flower has a charming story, each fluttering insect its fairy tale. A walk is full of delight, of mysteries and new problems. The whole landscape speaks to me. Familiar since childhood it is yet ever new. The encircling horizon line, broken by hazy silhouetted peaks; the nearer wooded hills, the cloud shadows that play among them; the cleared land checkered with its varying harvest; the near-by brook gurgling among the tangled ferns and flowers; the bird song whistled from the bough-tip; all are sources of exquisite pleasure. Nature study is a revealer. It adds a third dimension to the landscape. It delves below the surface to foundations. To the thoughtful man the outstretched view is not alone a beautiful prospect. It is a voice from the past and speaks of history as eventful as do the care-wrought furrows of the human face.

Some Experiments with Regard to the Relative Interests of Children in Physical and Biological Nature Materials in the Kindergarten and Primary Grades

Laura Emily Mau.

Introduction.

The time has come when nature study can no longer hold a rightful place in the curriculum by the mere organization of the work on principles that have been established and agreed upon by nature-study specialists. Not until we have farther investigated the matter and discarded the chaff by careful laboratory methods and the application of laboratory technique will sound and basic principles evolve upon which to outline a course of study in this subject.

The importance of beginning our investigations with children at the earliest ages available cannot be emphasized too much if the young child is to receive its rightful place in the educative process. It is his birthright. Thus far the kindergarten has scarcely been considered in the investigations carried on in the elementary grades, and if its influence is to be felt in higher education, the work in it too must be based on scientific principles of education.

Physical, chemical and biological facts constantly come under the modern child's observation at a very early age, and the separation of nature-study into physical and biological is merely a matter of convenience of treatment and does not mean that conscious abstraction is begun by the child.

Purpose of the Investigation.

An investigation was made to show the different attitudes children take toward three phases of nature materials; namely: plant life, animal life and physical nature material, and to see if some determining factors could be thus found to aid in the selection of work for the different grades. The investigation was carried on: (1) With regard to the relation of age and sex to the kind of object preferred; (2) To determine what the cardinal factors are in determining the preference; (3) To determine what the dominant interests are in each phase of material in the different grades.

Types and Location of Schools, Grades and Number of Children.

The investigaton was made in the Chicago schools and the location of schools and the types of children were such as to give us representative data. The following schools represent the distribution: Elementary school, School of Education, Chicago University; John B. Smythe, known as the "Ghetto," Forestville; The Carter Practice; The Parker Practice; Van Vlissengen; W. K. Sullivan; Myra Bradwell; Washington School at Lyons, a suburb; and the Hyde Park Baptist Kindergarten. The investigation was carried through four grades, viz: the kindergarten, 1st, 2nd and 3rd grades. Two experiments were made and responses were received from 1,988 children in the first experiment (Test A), and 2,085 children in the second experiment (Test B).

Materials.

In order to have comparable materials it was necessary to make the selection so far as possible equally attractive in exciting the spontaneous attention of the children. The materials selected for Test A were: (1) a pepper plant with many red peppers on it; (2) a gray cat; (3) a toy engine about eight inches long and five inches high with very complete works.

The materials selected for Test B were: (1) a sensitive plant; (2) a turtle-dove in a cage; (3) two bar magnets and iron filings.

The Nature of the Experiments.

The nature of the experiments may be stated briefly. To make the approach simple and direct, the following questions and instructions were decided on for Test A. (1) If you could choose one of these three things for your very own, which one would you choose?

Why?

Now you may ask any question which you would like to ask about any of these three things.

For Test B it was decided to have the children take active part in the experiment, i. e., feeding the bird, touching the sensitive plant so its leaves would suddenly close, and picking up the iron filings with the magnet. Then after a large enough number of children had participated in this, to take the materials away and let a week intervene before coming back to the room for the questions they wanted to ask.

Test A.

The results obtained show that there is a marked increase in preference for the cat for both boys and girls from the kindergarten to grade 3 in all schools; that there is a decline in preference for the engine for both boys and girls, especially marked between grades 2 and 3; that the decline for girls is very rapid; that there is very little variation from the kindergarten to grade 3 in plant interest, with a rise in grade 1 for girls. The greatest difference is that between the boys and girls.

The total results in choice show that more girls than boys choose the cat in all grades; the figures are as follows: Kindergarten, 4.2% or 1.2 times as many*; grade 1, 3.4% or 1+ times as many; grade 2, 19.9% or 1.5 times as many; grade 3, 7% or 1.2 times as many. More boys than girls choose the engine in all grades. The differences are as follows: Kindergarten, 9.5% or 1.5 times as many; grade 1, 29.9% or 2.1 times as many; grade 2, 40% or 4.8 times as many; grade 3, 26.7% or 4.5 times as many. More girls than boys choose the plant in all grades. The differences are as follows: Kindergarten, 15.8% or 2.8 times as many; grade 1, 21.4% or 3 times as many; grade 2, 19.9% or 2.6 times as many; grade 3, 19.7% or 2.4 times as many girls as boys.

According to the results obtained from the total number of questions asked and the number of children that ask the questions, the striking difference is that between boys and girls rather than between materials. Both from the standpoint of questions and number of children that asked questions about the engine, boys far exceed girls in all grades, with a marked decline from the kindergarten to grade 1 and from grade 2 to grade 3. On the other hand, the differences between boys and girls with regard to the number of questions asked about the plant are quite as great; girls, both in numbers and in the number of questions asked far exceed boys in all grades, with a striking rise in grade 1. The number of questions and the number of children that asked questions about the cat increases from the kindergarten to grade 3 for both boys and girls. So far we can say that there is a rising interest in the cat; a waning interest in the engine, and very little variation in the plant from kindergarten to grade 3.

It is interesting to note that the prevailing opinion of the adult was that the children preferred the cat in all grades, espe-

*The number times as many is based on numerals and not percentages.

cially the kindergarten. This experiment does not bear out that opinion. The fact is that the younger the child, the greater has been the preference for the engine.

Test B.

The tables of frequency show at once that the bird is pre-eminently preferred in all schools in all grades by both boys and girls without any marked variation from kindergarten to grade 3. There is not much variation in the preference for the plant, with a slight rise in grade 1; the main difference is that between boys and girls. There is very little variation in preference for the magnet from the kindergarten to grade 3, the greatest difference being that between boys and girls.

The results obtained from the total number of questions asked and the number of children that ask the questions, show that the interest in the bird exceeds that in the plant and the magnet for boys and girls of all grades. The number of questions pertaining to the magnet exceeds the number regarding the plant for boys in the kindergarten and grade 1, and for girls in the kindergarten; questions pertaining to the plant exceed in number those regarding the magnet in grades 1, 2 and 3 for girls.

Summary.

Summarizing the results obtained from the point of view of relative preferences, the number of questions asked and the number of children that ask the questions, these all show that the bird takes a predominant position in point of interest for all grades for boys and girls; the totals for boys and girls show that the interest in the plant exceeds that of the magnet in grades 1, 2 and 3, with a rise in grade 1; and the interest in the magnet slightly exceeds that of the plant in the kindergarten.

General Summary.

Stating briefly the results obtained in Tests A and B, the interest in the bird is paramount in all grades; the interest in the cat reaches its culmination in grade 3; the interest in the plant exceeds that in the cat in grade 1; the climax of interest in the engine is in the kindergarten; the order of interest for boys seems to be animal life, physical material, plant life; and for girls, animal life, plant life, physical nature material.

The Reasons for Preferences.

It was found that the cardinal factors for determining the

preferences are motor activity, sensory response, activity of the object, utility, ownership and "like it best." The motor activity gradually wanes in kindergarten to grade 3 and the climax for sensory response appears to be in grade 2. The nature of the young child is sensory and motor rather than reflective; activity is the key to the growth and development of the young child. Interest in caring for the plant and cat overtops use and function in kindergarten and grade 1, and construction overtops use in kindergarten and grade 1 with regard to the engine. "Beauty" as a reason for preference is far more dominant in grades 2 and 3 than in the kindergarten and grade 1; use, function and purpose appeal to the child rather than form, size, color, arrangement. There is greater variation in the reasons for preferring the cat, showing that there are more things in the animal to appeal to the child especially in grades 2 and 3, where there appears to be a marked increase in the animal interests.

Interest in Relation to Age.

From the point of view of children's questions, the plant interests have been grouped under nine heads: identification, activities of plant, life history, care of plant, color, sensory response, use, geographical distribution and miscellany. It was found that the dominant interests in the plant are in the growth and activities of the plant and identification. Interest in identification which is relatively slight in kindergarten, steadily increases and exceeds that in the plant activities in grade 3. Care of the plant seems to rank next and exceeds use by 10% in grade 1; 1% in grade 2, and 3.6% in grade 3; color and geographical distribution are not mentioned before grade 3.

The cat and bird interests, as they have been grouped, comprise a total of nineteen heads showing at once that the animal interests are far more numerous and varied. These can roughly be stated as activities of the animal, domestication, physical attributes, life history, food, sex, name, sensory response, ownership, miscellany. Those interests stimulated by the cat which are not mentioned for the bird pertain to classification, use, adaptation and moral qualities. Those included among the bird interests which are not mentioned for the cat are identification, home, care of bird, color, geographical distribution. The interests are in the main, centered about the activities of the bird and the cat. Identification is in evidence to a striking degree in the bird and interest in it increases rapidly from the kindergarten to grade 3. Care of the bird seems to claim the greatest attention in grade 1; struc-

ture is not mentioned much before grade 3; the naming of the bird is not mentioned before grade 2, and the name of the cat only once before grade 2. The added interests for the cat in grade 2 are, classification, name, sex, sensory response, and for grade 3, moral and intellectual qualities of the cat and adaptation. The added interest in the bird in grades 2 and 3 are name and color; sex and geographical distribution have not been mentioned before grade 3.

Conclusion.

In conclusion I would say that it is obvious from all points of view, according to this investigation, that at a very early age children are interested in physical phenomena as well as plant and animal life; that the young child is essentially motor sensory and dynamic. The kindergarten child's early motor interest is in the things that he himself can do, things for which he himself furnishes the motor power; it is the engine that he can pull and push; that he can take to pieces and put together again; the bird that he can feed and care for; the flower he can pick; the plant he can water and "make grow" that are of primary interest.

Children's toys furnish to the child opportunity for much experimentation and constructive play; it is in the appropriate selection of toys, i. e., toys to meet the child on his own level, the direction, guidance and utilization of these play impulses in educative channels that nature-*play* passes into nature-*study*. We must keep alive the eagerness to find how things *work* and are *made* in order to establish the scientific habit of mind.

Nature Study in Terms of Materials.

In terms of materials then we can say that the child should have "active" materials, i. e., materials with which the child may construct, create, produce and actively inquire. The child's instinct to nurture, to protect, to control should be fostered in the care of animals and plants. It is fundamental then that the age of the child must be considered in selecting animals and plants of which the young child may make pets. The instinct to make, to create, to investigate, to explore should be encouraged in the physical nature materials, simple physical experiments, the school garden, the home garden under the auspices of the school, the excursions. The crucial thing is, that it is "real" things in relation to "real" life processes that interest the child. And no amount of symbolization or pseudo-science can give to the child the elements necessary for constructive thinking upon which

the success of the science work in upper grammar grades and the high school depends, and upon which the progress of science in life depends.

We have seen from the point of view of children's questions, that the animal interests exceeded all others at all ages; that there was an increasing interest in animal life with advancing years and that the awakening of new interests was very marked in grade 3. It is clear enough that there must be an increasing importance given to animal life in the organization of nature-study work. Miss Lee, who has charge of the lecture work at the Children's Museum at Brooklyn, says that the zoölogical lectures are infinitely more interesting to children than the botanical at all ages; that the children are not only more interested, but that the lectures are better attended.

Finally, I would say that one of the greatest values of this sort of work is that it discovers to us the problems that need to be worked out. For example, the difference in the interest shown between the bird and the cat shows that there is a difference in the kind of animal that makes its strongest appeal at different ages. The difference between the interest in the toy engine and the magnet shows that there is a difference as to the kind of physical material that makes the strongest appeal at different ages. Thus it is only by careful studies that correct practice can be established. Again, with regard to children's pets, the problem of possible instinctive repugnance to certain animals presents itself; the experience at the Brooklyn Museum is that the younger children take great interest in carrying around and making pets of snakes, while the adults pay no attention to them. Thus we can say that the subject of nature-study is by no means a settled problem, but that there is still a curriculum based on scientific principles to be worked out by the nature-study advocates, if this subject is to be worthy of its name.

Collecting Things

EDWIN E. HAND.

Our books on pedagogy and psychology have a great deal to say in regard to securing the attention of pupils and maintaining interest in their work. The terms "self direction," "correlation," and the like are of frequent occurrence. Now, it is easy to criticise and to find fault. It is not so easy to suggest a better way. It is difficult indeed to initiate and successfuly carry out plans which embody the high ideals of the philosophers.

After seven years of trial with steadily increasing success, we think we are doing things worth while in botany and zoölogy, and they are so simple it is strange they have not been thought of before. The following brief outline of the work is given and must not be taken seriously by teachers who are unwilling to do extra work or to learn something new. But to those who feel that "the day I cease to learn, I cease to teach," they are offered gratis.

Many of our great scientists agree that the desire to collect things is innate in a healthy child. And Darwin says "I cannot stomach a grown man collecting stamps." Be this as it may, we take advantage of this "collecting mania" and conjure with it in our work. In botany we collect leaves, seeds and woods. The many hours spent and the ingenuity developed in fixing up these collections are nothing short of marvelous. "Where did you get them?" and "How did you ever fix it so nice?" are often heard in the biological rooms. In zoölogy we each make a little cigar box collection of insects, beginning in September and one of shells about a month later. As far as we know, we are the only high school which does this.

The insects are caught, killed, pinned and classified into orders and genera. Their life histories are studied as far as possible, and the facts the boys and girls learn "on the side" in this kind of work far outnumber those emphasized in the class. The little "bug houses" are taken home and fondly cherished.

But when it comes to the "shell game" we simply go crazy! And if you think differently, just come in some morning an hour before school, or stay two hours afterward, and see who's there. Each cigar box is partitioned into spaces about one inch square, this work bringing us into "correlation" with the manual training department. And the girls and boys, too, who do not take manual training think the man down there is just lovely.

The pupils collect all the common land and fresh-water forms obtainable here and thus learn in a practical way the habitat of the "dim, dreaming life of the snail." And it is surprising how they find things which the teacher has overlooked—Pyramidulas and Valvatas in Washington Park and Vallonias almost in the shadow of the schoolhouse.

Then we write to friends at the sea coast, and also to dealers, for marine species. And when we have a box full and each specimen on its bed of white cotton, covered with a nicely fitting glass and the names on inside of cover, we have something to exhibit to our friends and our friends' friends, even to the third

and fourth generation. Our little exhibit last year of 200 boxes and about 8,000 specimens on which the fond mothers and fathers gazed so admiringly, was an event that still lingers in the memory.

A certain "crank" has said: "Get your pleasure out of your work or you will never know what true happiness is"; another is applying this idea in the high school work.

Now, if you wish to take up this work, just begin, and watch it grow! There is at least one man in each state who will be glad to help you. Find him, and if he does not immediately exemplify the saying of the great Teacher: "It is more blessed to give than to receive," he will be the first exception I have ever known. And I am never too busy to help you.

Wendell Phillips High School, Chicago.

Observation Cages

EARL LYND JOHNSTON.

Principal, Independence School.

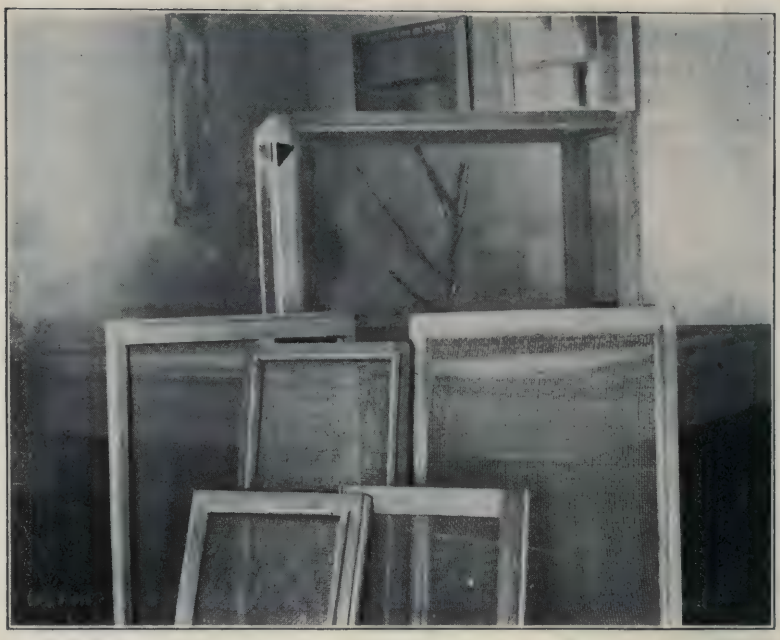
FT. LUPTON, COLO.

Desiring to have some nature study when I was in charge of a two-room graded rural school, I found that I needed some cages for observations. I evolved a plan whereby these cages might be easily made and put together and at the same time be easily crated to move from place to place. I was so well pleased with my cages and found them so handy, that I thought I would pass the plan along.

One of the cages was made for the study of insects and the other one for the study of snakes and other small animals.

The cages are alike, excepting the wire. The insect cage was covered with common screen door wire and the other with a heavier wire, about eight meshes to the inch. Each cage has five parts, sides, ends and top each made separately. These parts can be put together without the use of nails, screws or hooks by having the ends rabbeted to the sides. The top fits flush with the inside and is held up by a strip along the inside of each side of cage. As these cages have no bottom, they can be placed in any condition one wishes. I made a box for mine in which I placed dirt and fine sand.

The material used was clear two-inch pine, one inch thick. The dimensions are: sides 36x24 inches; ends 24x18 inches; top to fit inside these dimensions. They cost three dollars each, and ought to last a life-time.



THE CAGES SET UP AND KNOCKED DOWN.

I have had many interesting things in these cages, and they have done much good even to country children.

What Birds Have Done for Deficient Children

CYRUS D. MEAD

Past Principal Indiana School for Feeble-Minded Youth.

"THE FLICKER'S NEST."

"About three weeks ago I saw a hole in a little old willow tree on our play grounds. I climbed up on a box to look in the hole and a mamma flicker flew right out in my face. There were a lot of little chips on the ground by the tree. I lay down on the ground. She came back to the hole and went in the hole and stuck her head out two or three times.

"Then she brought up more chips and dropped them on the ground. Now she has a nest there. Now she is not afraid of me. I can go up nearly to her and she will not fly away. She

is tame. Sometimes she scolds me but I would not touch her nest, for I love the birds."—Thos. Lee D.

The above story is one of many written by school children of the Indiana School for Feeble-Minded Youth at Fort Wayne, Indiana. Twenty pages of original bird and nature experiences of these children were given in the "Indiana Arbor and Bird Day Annual" of State Superintendent Cotton in 1907-8. This material furnished the basis of an institution "Reader" now in the hands of the state printer for publication. The State Superintendent in his preface of the Annual to the teachers and pupils of Indiana said: "Late in the autumn I visited the school at Fort Wayne and found teachers and children so much interested in birds and nature in general that I decided to place as much space at their disposal as they wished. The result is more than gratifying."

It is a great privilege for one to be so fortunate as to come in contact with the sometimes keenly perceptive powers of a child to whom book learning comes with pain. What the bird and bee and flower and nature rambles have done for the ordinary boy, they have done for his slower brother. They have meant just as much to the deficient child if he has been allowed to see them.

The education of the past has been too much the training of the intellect, for with it crime and vice, grief and bitterness have gone. Today, more than ever before, this intellect training is being balanced by a moral and an aesthetic teaching. Hand work serves its means rather than finds its end, but nature work goes to the heart. Not the nature work of the high school botany and zoölogy of past days, taking the object to study its petals, its feathers, or its bones, but the nature work in the school of "feeling" and the school of "seeing." This is the spirit of the nature work in the Indiana School and it has carried its benediction into the heart of the child as well as into the heart of the teacher.

Not so much is made of nature "study" as nature "feeling" and nature "seeing." The father of Greek education said, "knowledge" was the thing. "Know thyself." His pupil and disciple, the best educated man the world has ever seen, inspired the present-day teaching by answering that mere "knowledge" of good was nothing, but a "functioning" of that knowledge, a "living" and a "feeling" and a "doing" of that good. These children never heard of a dentate, stipulate, palmate leaf or leaf arrangement but they have "seen," in the sticky horse chestnut bud, order, symmetry, and protection. They do not know and

do not care whether the ichneumon fly is a hymenoptera or just a plain insect with wings, but in the collection of two hundred tussock moth caterpillar cocoons in one walk around their administration building last fall they "felt" God's protecting care for us through his placing this little parasitic fly in the larvae of our shade trees' ravagers. They do not know the difference between a sepal and a petal, but a boy of one of the upper grade schools took clandestinely a trillium from the waste basket under the teacher's desk and pressed it in his book because, as he told her, "he could always study better with a flower on his desk!" A division of bright little chaps tussled and sweated hour after hour to dig worms to toss to a limb where a mother robin took them to feed her babies. If you should tell them a "Troglodytes aedon" was in the Rose of Sharon bush outside their kindergarten window they would stand speechless and dumb, but if their wren should "say his beads" as he never forgets to do, from his bird house which occupies its place close to each school, the windows would be stampeded without ceremony.

A "shrike" that built its nest on the north side of the grounds, preened itself, within four feet of its nest, while kindergarten children fed "bugs" to the handsomest babies of the bird world.

The blue jay was made to bury his acorns and "sass" his neighbors from the limbs of trees. One was found once on the grounds hanging head down entangled in his own nest building. One Boys' room took a morning off that that bird might be disentangled, taken to the fair ground woods and liberated. Boys will fight, actually fight, for the protection of nests and birds when a few years ago wings of the young of sparrows were pulled off to see them suffer. The general spirit of observation, sympathy, kindliness, charity, "seeing," "feeling," "love" has been abroad in the Indiana School and the bird is the progenitor.

They believe with Van Dyke, that, "There is more of God in the peaceable beauty of the little wood-violet than in all the angry disputations of the sects." That, "We are nearer heaven when we listen to the birds than when we quarrel with our fellow-men." They have felt with Ruskin, that, "The greatest thing a human soul ever did was to 'see' something; that to 'see' clearly was poetry, prophecy, and religion all in one." While they have a weak will to appeal to it does not follow that the emotions are equally infirm; for the heart after all "sees" and the heart "feels" and the heart "knows," and a heart can not be feeble-minded.

School Gardening—Some Cautions

E. C. Bishop.

Every new movement of worth brings to its support a greater or less number of earnest advocates whose helpfulness is much discounted because of the failure of such persons to fully acquaint themselves with the principles governing the direction of such work. A too hurried plunge into the new work without acquaintance with some of the governing influences, brings many a failure to what might otherwise be successful effort on the part of the individual, and also reflects discredit upon the cause which it is aimed to promote.

In the earlier work especially, in nature study, over indulgence in the study of "fancy" points about meaningless subject matter developed much distaste on the part of pupils, brought forth scoffing from parents, and diverted support from a most valuable factor in education.

Injudicious application on the part of misguided teachers has brought to the term "Nature Study" the application of discrediting expressions and judgments from many who would otherwise be real friends of the cause. In like manner, school gardening has suffered at the hands of many of its friends. Too many teachers with progressive ideals and the desire to be helpful in promoting the work in school gardening have failed to get their bearings before beginning activity.

Zeal and loyalty to a good cause are most desirable qualities in every teacher, but those characteristics must be measured out in a full complement, which includes knowledge and understanding of governing conditions, and caution and discernment in practice.

Every state has its mile stones of progress in school gardening intercepted with tombstones of failure because of the reckless plunging into the work and the floundering about therein of friends of the cause who have used more zeal than judgment in their work. The weed patches and waste places which through the summer time have marked the remains of school gardens, poorly planned and inefficiently executed, are landmarks of discredit and discouragement which are more injurious to the development of the good features of school gardening than are the direct neglect or disfavor of those who know not of its value when properly conducted.

And these hurts come from the hands of friends who have

seen visions of good in the work but who have not studied the way to its realization. Some see their error early and readjust the view point and line of attack. Others count their failure an evidence of effort in a weak cause, and retreat from the sunrise of a possible victory.

This grievous mistake most often made, is that of starting a school garden under conditions unfavorable to successful results. The school garden started just to have a school garden is an unnecessary burden, a pedagogical blunder, a foredoomed failure and a source of unfair criticism of a good cause.

No school garden should be started unless it has specific function or is to meet a particular need. The need of a school garden varies with the kind and grade of school, the course of study, the community interests and the conditions under which it may be or must be maintained.

Some of these needs are:

1. The need of an experimental plot where pupils may try out experiments which are concerned in their school or home work.
2. To beautifying the school grounds.
3. To provide outdoor activity of the quality needed by pupils.
4. To afford a better at-hand study of processes or products than can be otherwise secured.
5. To furnish products needed by the school, by the pupils, or by their homes.

With a good purpose in view there are yet reasons why a teacher may be justified in not conducting a school garden. Among these reasons the following sometimes apply:

1. The growing season is too short or otherwise unfavorable to securing results during the season when school is in session.
2. The possible location of a garden plot, or the condition of soil may be so unfavorable as to prevent even a reasonable degree of success.
3. The other duties of the teacher may be such that sufficient time and close attention cannot be given. A school garden needs a careful, constant, faithful, thinking, planning, executing and persevering overseer during its entire period of beginning, growing and harvest. It is easy to create interest enough to start a school garden. To keep this interest, and to get satisfactory results require a far greater degree of talent and of applied art.

4. Sufficient protection of the garden against trespassers—all kinds—may not be possible.

5. The teacher may not be able to remain with the school garden after the close of school to see that it is properly cared for and it may not be possible to secure other dependable authority to close up the garden in a creditable manner after the departure of the teacher.

The above do not include many items that might be mentioned, but which can generally be handled successfully by the really interested and competent teacher.

The school garden should have a definite, clear-cut purpose which should contribute to a real need in the education of the pupils concerned. The school garden is a delightful work when properly conducted, but never a plaything or an idler's loafing place. It does not deal in fancy, faddish, far-fetched applications of doubtful value, but it does deal with real things of value and problems of lively, timely and self-educating interest. Its ethical value depends upon the usable value of what it produces, in exercise, thinking and products which the pupil recognizes as worth while.

The school garden must be a success in the quality of its products and in the appearance of its condition throughout its course. Dwarfed, faded, shabby vegetables and flowers; third rate fruit and sickly experimental plants; carelessly made rows and weedy patches; neglected cultivation and careless handling—many or all of these reflect failure on the part of pupils, teacher, school, and last upon the "school garden" which is subject to failure or success according to the fate meted out to it in its self-chosen "director" or the time, place, condition and purpose of its being where it is, when it is, and what it is.

The uninitiated teacher is liable to attempt too much, or to attempt to do the wrong thing. Too many naturally beautiful school grounds have become the unsightly remains of an ill-timed school garden. School yard grass is much better than school yard weeds and overgrown flower beds.

A most successful school garden may consist of a few square feet of good soil used as a simple germinating plot, for seed testing, for the comparative development of young plants, and the identification of plants by appearance. The planting of small quantities of wheat, oats, barley, and rye seeds for the study of the differing appearance of the young plants to teach identification of young oat, wheat, barley or rye fields, affords a valuable and interesting experiment. Likewise, the planting of certain

common vegetable and flower seeds that the pupils may learn to know the young plants and thus weed and protect them better in their home gardens is good school garden work and can be conducted with credit to all concerned, when the planting of seed just to have a garden and raise some well known radishes, onions, or lettuce might fail in its purpose.

Some of the best results I have seen in school gardening came from the use of boxes filled with soil and planted with seeds, for the purpose of studying germination and comparative young plant recognition.

Except in the crowded city where but few home gardens exist, the best use of the school garden is an incentive to children to operate home gardens. The little experiments in the school garden should teach lessons in principles which the child may apply in the conduct of a real garden at home.

The city school garden with its paid gardener who manages it during the year is quite a different proposition than the school garden where the teacher alone is responsible for the work.

The school garden conducted, for a purpose, with the application of good judgment and constant, faithful attention is a most delightful means of enriching the education of pupils and of keeping the teacher closer to the real principles of teaching. Let those who are not in position to successfully carry it out proceed carefully not only for the sake of their own professional happiness and success, but for the sake of a good cause which has too often suffered at the hands of its good, but misguided, friends.

Hygiene as Nature-Study

F. M. Gregg.

Peru (Nebr.) State Normal.

III. A Study of the Skin.

The purpose of the hygiene study for this number is to provide a basis for developing or magnifiying the importance of habits of cleanliness. The schools may not themselves be able to set up all kinds of habits that are desirable in its beneficiaries, but they can at least make some effort in this direction and can supplement and coöperate with the efforts of the home for these desirable ends.

A. The Nature-Study Approach.

1. *Microscopic study of the skin surface*—(a) Take a simple

magnifying glass, such as every teacher or schoolroom may well have and such as is used in botany work in the analysis of flowers, etc. Look at the back of the hand first and notice how rough and seemingly scaly the skin of the hand is. Recall how on warm days or when one is sweaty one can readily scrape stuff from the surface of seemingly clean skin. If one were to let some of this stuff (called scurf) dry up and then examine it with a simple microscope, it would be found to be made up of a lot of scales, skin cells dried together. These outside cells of the body are dead and non-sensitive, as any schoolboy knows, who, in the absence of more interesting work, spends part of his time in sticking pins under this dead outer layer of the skin.

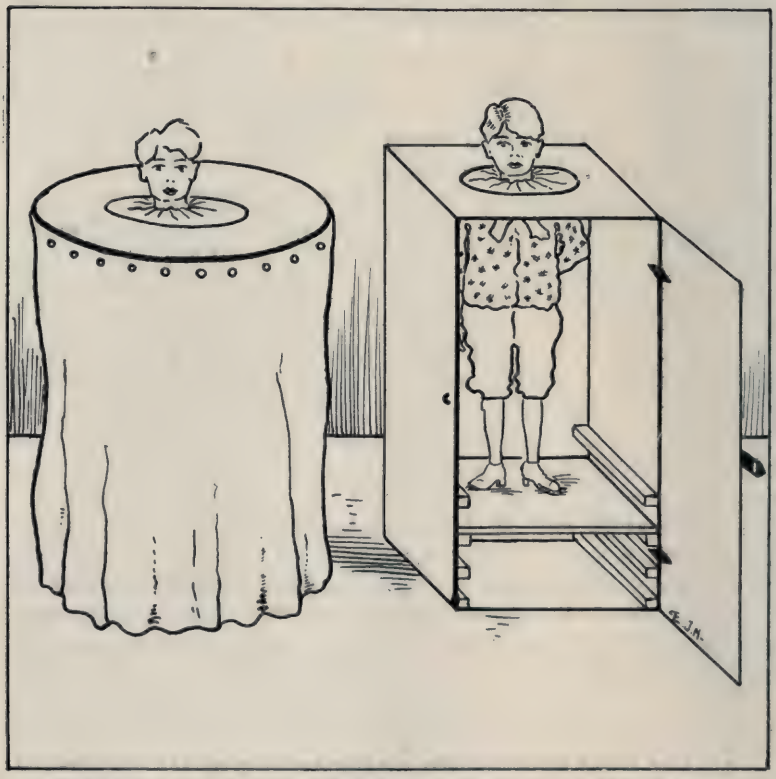
(b) Once more look through the magnifier at the skin of the hand, this time on the palm. Notice the little ridges. Now look very sharply for tiny little depressions along the top of the ridges. The depressions are as if they had been made by gentle pin pricks, and average a little less distance apart than the width of the ridges. If one is sweating just a very little, extremely tiny drops of water may be seen at each of the depressions. This is because here are the outlets of the sweat pores of the skin. Similar depressions can be found all over the skin, but they are not so readily made out elsewhere.

2. *Demonstration of "insensible" perspiration.*—We know that moisture stands out over the skin when we are quite warm and the previous study as well as our general knowledge tells us that the moisture comes out of the skin itself. On colder days we are not so certain about the presence of this moisture. To find out about it we need a day or a place where the temperature is, say between 50° and 60° F. In such a temperature a pupil may put his hand into a quart fruit-jar, not allowing the bare skin to touch the jar, and stopping up the unoccupied part of the mouth of the jar with a handkerchief. Thrusting a thermometer tube (a dairy thermometer is excellent) into the jar the temperature will be found to be between 60° and 70° F. To provide a "control" for the experiment so as to make sure of the conclusions, have at hand an empty and lidless jar in the place where the experiment is going on. After ten minutes examine the inner surface of each jar. On the one the hand is in there appears a film of moisture, but not in the other. So it appears that a little perspiration is going on even when the surrounding temperature is as low as 50° or 60° F.

3. *Are there decay germs on the surface of the skin?*—(a) We are told that decay is caused by germs and we learned from

our study of teeth that germs are found in the stuff that gathers between the teeth. We also are told that germs of decay thrive where there is dead stuff and where it is warm, moist, and out of continued direct sunshine. Naturally we might well look for germs on the skin, therefore. If a compound microscope with an oil immersion lens is at hand, and the teacher can make a stained mounting of scrapings from a pupil's skin, the presence of germs can readly be demonstrated.

(b) In the absence of the microscope, a gelatin culture medium, such as is described in the December, 1911, Nature-Study Review, page 274, can be employed. Apply some scrapings from the skin to the medium, and also some bits of decaying organic stuff of any kind, to another part of the medium, and set aside in a rather warm place for two or three days. There will appear colonies of bacteria easily seen with the naked eye.



Apparatus to Detect Decomposition of Skin Refuse.

(c) To bring home to each individual pupil the fact and results of this skin-surface decay, each pupil needs to be placed in some such apparatus as these shown in the figures below.

Let each pupil remain with his body in the enclosure for ten or fifteen minutes, his head meantime exposed to fresh air. Now on getting out of the apparatus, he must be made aware of the odor of the air that stood about his body and thus he has opportunity to know that however recently he may have bathed, decay still goes on.

B. Hygienic Questions and Conclusions.

What is the character of the odor of decaying stuffs generally? What do you suppose is the chief reason why the air of poorly ventilated schoolrooms smells bad? Is there any difference in the odor of a church after a Friday evening service and after a Sunday morning service where the usual American bathing custom prevails? What is one reason why inhabited rooms have to be ventilated? What is the primary reason why you and I should bathe? Some of us who are older were taught that we need to bathe in order to "keep the pores of the skin open," but you and I know that the hands may be ever so dirty and sweat will still come out of them, so you are right in thinking that we bathe primarily to keep clean, and thus reduce germ activity and offensiveness to our neighbors through bad body odors.

Which is better, to use strong perfumes and thus obscure the odor, or to keep as clean as we can and thus reduce the odor? Are there other reasons why we should bathe? How often do you think one needs to bathe? What time of day would be the best for one who has to work amid dirty surroundings? What time of day is best for other people? What besides cleanliness is to be gained by taking a short cold bath every morning? Let us try this a while and see what happens. Who will agree with me to do it?

C. Some Follow-up Studies.

Following these inductive studies the pupils may be sent to the simpler text books on hygiene for a study of methods of bathing, etc., etc.

The apparatus figured in this article may be used very advantageously and very impressively for a further study of the need for ventilation in inhabited rooms, provided the pupils are old enough to appreciate it. Let each pupil, taking a fan into the "sweat-box" with him, remain in the box till he gets up a

good sweat and declares the air is "close." Now arrange in some way to take the temperature of the air in the box. Let the pupil now stir the air vigorously inside the box by means of his fan and again let the temperature be taken. The thermometer will show little or no difference, but the pupil will declare that it seems much cooler. The circulating air breaks up the vapor jacket that has formed around the pupil's body and evaporation of the sweat now goes on much more rapidly. With the pupil still in the box, let some one now fan him vigorously in the face. Ordinarily he does not experience nearly as much relief as when his body was fanned. He did not need fresh air to breathe, but he did need the breaking up of the heat jacket about his body. Ventilation does this for one remaining quiet in a room where the temperature is 70° F. or upwards.

"The Little Red Hen"

Louise C. Weed.

In the Nature Study work of the Brooklyn Training School For Teachers each student submits a record of *first hand observation* on some bird in connection with the bird work. The following is one of these sent by C. A. Mathewson for the Review.—Ed.

"Dear me, there you go again, mussing up my nice black feathers that the best of hens would be proud to wear. But then! what can one expect but jostling when one is thrown in with such a lot of underbred creatures?"

"I am sure, I beg your pardon, for disturbing you. I only want to get a breath of fresh air. As you very well know, it is quite close in this small crate with so many in it and with every body scrambling to get near the slats. And as for being underbred, I rather think I come from just as good a family as you do, if you are a stuck up Black Spanish. No Long Island Red ever yet stood back for any body, and good reason for it, too!"

"You don't say so! Well, well, there is nothing like having a good opinion of one's self. However, I will admit that you arouse my interest, and as it does seem that we are likely to have a long journey behind these old farm horses, suppose we drop hostilities and wile away the time with our respective life stories. Being the elder, perhaps you might begin."

"Very well. To repeat what I just said, the Long Island Red is as good a breed of fowl as there is. I myself am a pure specimen of this family and an account of my life will be typical of the life of the best hen that ever scratched gravel on a farm.

"I was born the first day of April, nineteen hundred and eight, on a large chicken farm on Long Island. I was hatched with several dozen other chicks in an incubator and I assure you we were queer looking things at first. By the way, were you hatched in an incubator? No? It is an interesting process. After the eggs are put in the hatcher and the little chicken inside the shell becomes too large for it, it picks a little hole in the shell from the inside and when the hole is large enough, it pushes its way out of the shell. When the eggs are hatched by the true mother hen, as soon as she hears her little chick picking to get out, she helps it make this hole in the shell with her beak. But it was not thusly with us. Yes, we were queer looking things, very weak, not even able to hold up our heads, while we looked as though we had been drowned. Nevertheless, as the heat in the hatcher dried us, we grew stronger, while our few feathers grew downy and soft and began to grow out 'til we looked like yellow puff balls. I say yellow, for most of us were of that color, but I remember one that was real dark and several that had dark stripes over their backs. But these were few in comparison. After we were quite hatched we were taken out and given some bread crumbs to eat. We soon learned to feed and to drink, too, though I must admit, we fell into the pan innumerable times and got more water on the outside than within. Nothing could discourage us, though. Every day we came to look more and more like full-fledged chickens. By this time you could see our wing feathers beginning to look less fluffy near the base and more like little quills. Soon we could relish cracked corn and from that day on we grew rapidly, but not without obstacles to overcome.

"There is a most dreadful disease which young chicks are subject to. Especially is this so on farms and fruit places where chicken raising is not made the sole business of the owner. This I learned in my second home of which I shall speak later. The disease is commonly known as the gapes. In such a case the unfortunate's windpipe becomes clogged and in his effort to breathe he yawns at almost every breath. If something is not done to cure this the patient will die. The old-fashioned method used by small chicken holders is to soak a long quilled feather in kerosene, to thrust this down the windpipe and by a twisting motion to dislodge the evil member. The first application, if successful, rids the chicken of his distress and he goes on his way rejoicing.

"After four months, during which time we had graduated to

whole corn kernels, we were allowed to roost at night in a grown-up hen house. Here were poles thrust from wall to wall (which were white washed) at a little distance from the ground upon which we would alight at night after more than one futile attempt. You see, our weight prevents us from being good flyers. Some of us went to bed earlier than others, but we all straggled in about sunset, because we do not see well at night, and after much flapping and subdued croaking would tuck our heads under our wings and go to sleep.

"How well do I recall one such night! There was a sudden light; which I found later to be from a lantern; some one said, 'There is a fine one,' and I was grasped by the legs, carried so to the outside and put into a crate, similar to this one, and to which some of my companions followed. The next morning I arrived at my new home.

"Here I discovered new conditions. There was a much smaller house, though it was very clean, which contained only one room for all. Along the sides boxes were nailed and filled with hay and straw, besides several barrels filled to the top in the same manner. For each nest there was a cold hard white egg. It was the queerest egg I ever saw, but I came to know later that it was a China egg, placed there to deceive the poor hen and to induce her to lay a real egg. There was a small yard surrounded by a tall wire fence. Here we were fed with corn and here we spent the day until an hour before sunset. Then there was a grand rush through the open gate.

"Once without, we all scattered. One group went into the newly plowed and sown grain fields nearby and was soon busily engaged in scratching up the grain. Along would come the farmer's wife who would wave her apron and call, 'Shoo, shoo,' in a high pitched voice. But as soon as her back was turned, we would repeat the performance. How persistent we were! Another group sped for the garden where they found juicy tomatoes, seedy cucumbers, crisp lettuce and beet tops, excluding the number of unfortunate insects. But the orchards afforded more insects, besides fallen fruit, while seeds of weeds abounded. There were nice sharp pebbles and bits of shiny shells there, also, which helped out immensely, aiding in the digestion of our food. During this short period, we all worked very hard, except the cocks, who only made believe.

"These roosters were our pride and joy, though we could never believe in them. They it was who mounted the post at sunrise and crowed cock-a-doo-dle-do and who presaged the

storm at night. They were much gayer than we, often sporting seven or eight colors, while they possessed the most adorable drooping tail feathers, bright red combs and sharp spurs. Somewhat larger than the hens, they frequently fought each other with these sharp spurs and at the finish there was always one boss cock in the yard, and only one, which fact was strenuously impressed on the defeated one. However, victor and victim were on the same footing in the following regard. Let Mr. Cock unearth a choice morsel, let him cluck to his many wives, let them fly to him, only to be just in time to see the fat worm disappear down his own throat. Foolish women, we never learned; as many times as he called, we ran—and—as many times were disappointed.

"As has been said, the faithful hens were more subdued in color than the cock. Some of us were a reddish brown; some, who belonged to the Plymouth Rock family, were black and white; some, that were called Leghorns, were pure white. Only the pygmies, the Bantams, were brilliantly colored. Though subdued, our colors were not always protective. During the day we were easily seen by the chicken hawk, our worst day time enemy. When we elders saw or heard him, we would stand very quietly or we would run and hide in the bushes. The younger chicks that were not yet trained to scent danger, often fell a victim to him. So when the mother hen saw the hawk, she would make a queer noise in her throat which said, 'Keep still and hide.' The little ones were very, very obedient. Sometimes they would run into the tall grass or huddle under mother's outspread wings. Here they would stay until their old enemy was out of sight. Then they would all wander on to look for more insects, which their mother showed them how to find.

"How well I remember the long walks I took with my first brood! In April of the second year of my life at the new home, the farmer gave me twelve eggs to hatch. These I kept warm for three weeks, only getting off to partake of a few kernels of food and some water. Some of the other hens were not good mothers, often leaving their eggs for so long a time that they would be chilled. But I had ten pretty little chicks to repay me for my trouble, while the careless mothers had only half as many. What became of the other two eggs? Well, you see, I stepped on my eldest and killed him. It is very hard in a small nest to get one's big feet in somewhere so as not to squash somebody. It was a most anxious time, I assure you. The other egg never hatched, so that accounts for the two missing eggs.

"My chicks and myself were kept in a coop for a few weeks. The slats in front enabled them to run about, but because I could not get out, they never wandered far enough to be lost in the grass. We were soon allowed to go walking, however, so that we presently forgot our weeks of confinement.

"But, alas, children will grow up. When late summer came, my chicks were quite independent of me. As time passed they became fat and well fed in appearance. Alas, again, one night the farmer caught all my boys and all but two of my girls, my sweet little pullets, put them in a crate, and next morning drove off with them, as we are driving now. I never saw my children again! The two pullets remaining comforted me. Finer and finer they grew until, late in the Fall, they presented the farmer's wife with their first eggs, which were very small indeed. All winter long, every other day, they each laid a nice brown egg. Our owners were surprised for hens do not lay well in winter, but we were full blooded and were fed with warm bran, potatoes boiled in grease and water, beside corn and scraps. So now, in my separation from them, I am consoled by this thought that I can trust them to fittingly uphold the honor of our ancestral name, Rhode Island Red!"

Ended was the red hen's tale. Silence reigned, save for the sound of the wheels passing from the dirt road to the smooth pavement of the city street and the clatter of the horses' hoofs on the same.

"Guess you've bin to sleep, son, eh? 'Spected you'd fall off a'fore this from the top o' them crates. Ear most squashed? Wall, wall, now, I don' wonder, ye had it right over that crack in the crate. Should have thought those hens in thar would ha' kept you awake. Eh? Ye waren't asleep at all? Ye heard every word they said? Who said? There, there, son, ye have not yit woke up. We'll soon have these pesky old hens of Farmer Brown's sold and ours too, and then we'll have some hot coffee to rouse us up a bit, eh?"

But Son never said a word. What was the use?

News and Notes

Special Offer to Teachers.

Fifteen thousand dollars is at the disposal of the National Association of Audubon Societies to be used during the school year of 1912-13 in aiding teachers and pupils to push the work of bird study in the schools.

In expending this fund the Association plans to provide the teachers, without expense to them, a number of publications on bird study, including a complimentary subscription for one year to the beautiful magazine "Bird-Lore," the usual cost of which is one dollar. For the pupils a set of ten colored pictures of American birds from original drawings made for the purpose by the best artists in America, and also leaflets discussing the habits and activities of the birds and an Audubon button are supplied upon receipt of a fee which is merely nominal, and which does not cover one-half the cost of publication.

By this method of co-operation, the Association during the school year of 1911-12 was able to supply material to teachers which resulted in about thirty thousand children receiving systematic instruction in bird study. This was all done in connection with their other school work, and did not interfere with the regular school duties in the slightest. Teachers from all over the country have written with the greatest enthusiasm of the way in which this movement is being received by the pupils and also by the parents.

The following endorsement is given to the work by Hon. P. P. Claxton, U. S. Commissioner of Education:

"I consider the work of the Junior Audubon Classes very important for both educational and economic results, and I congratulate you upon the opportunity of extending it. The bird clause in the Mosaic law ends with the words: 'That it may be well with thee, and that thou mayest prolong thy days.' The principle still holds. I hope that through your efforts the American people may soon be better informed in regard to our wild birds and their value."

All teachers interested in nature study are invited to write to the address given below and make request for sample pictures, buttons and literature, all of which will be gladly furnished upon application. Correspondence should be addressed to T. Gilbert Pearson, Secretary, 1974 Broadway, New York City.

The editor takes pleasure in calling special attention to the above. The Audubon Society is doing splendid work in protecting our birds and stimulating kindly interest in them.

Mr. C. A. Stebbins, who has been connected with the Division of Agricultural Education of the University of California during the past two years and has given special attention to nature-study and gardening in the elementary school, has resigned

to take charge of that work in the Chico Normal School. He will continue to publish the "Junior Agriculturist," which will be sent to any grammar school pupils in the state desiring it. The position left vacant by Mr. Stebbins' resignation will be filled by Mr. F. L. Griffin, formerly of the Boise (Idaho) High School, who will give most of his attention to high school experimental work in connection with agricultural instruction, and to such high school extension work as we can organize with our present staff. —E. B. B.

The initial meeting of the Grand Rapids Nature Study Society was held September 17th, in the lecture room of the Junior High School.

Paul C. Stetson, President of the Grand Rapids Teacher's Club presided at the meeting and gave a brief history of the American Nature-Study Society; also suggested the objects to be achieved in the organization of a nature-study society in Grand Rapids. Before organizing, a number of brief talks were given by those present who were most intimately acquainted with the Nature-Study movement.

The following officers were elected by the charter members: president, Mrs. Lou I. Sigler; vice-president, Miss Clara Ward; secretary, Miss Grace F. Ellis; corresponding secretary-treasurer, Miss Ora May Carrel.

A committee to prepare a constitution was appointed by the president, to report September 25th. The objects of the society as set forth in the constitution are: (1) To encourage and promote local interest in nature-study; (2) to meet the problems of teaching nature-study in our city; (3) to become acquainted with the nature-study movement.

After the adoption of the constitution there was a discussion of plans for work and study sections will be formed in several nature subjects. Besides the field work conducted by study sections, longer excursions will be planned to places of interest near Grand Rapids.

The first regular meeting of the society was held Thursday evening, October 10th, at Ryreson Library. Dr. Otis W. Caldwell of Chicago University gave his splendid address, "The Place of Nature-Study in the Education of Children."—Ora May Carrel, Cor. Sec.-Treas.

Note special offer to old subscribers on back cover.

The annual election and business meeting of the St. Louis section of the American Nature Study Society took place Saturday, Sept. 1, 1912, the following officers being elected: President, Mr. L. M. Dougan, Shaw School; director of the National Society, Mrs. W. J. Stevens, Field School; Secretary-Treasurer, Miss Elyse C. Crecelius, Harris Teachers' College; members of the Executive Committee: Mr. J. A. Drushel, Harris Teachers' College; Miss Ada Plass, Grant School.

The first Fall field trip was made Saturday, Sept. 28, 1912, to Crecent, Mo., about fifty members attending. The day was a beautiful Fall one and many interesting Autumn studies were made.—E. C. C.

The cities of Los Angeles and Pasadena have taken a most progressive step in the appointment of special supervisors of nature-study, school gardening, and agriculture in the elementary schools. Los Angeles has secured the services of Mr. C. F. Palmer, formerly head of the Department of Agriculture in Gardena Agricultural High School. He will act as chief supervisor. Under him there will be half a dozen special supervisors, some of whom have already been appointed. Pasadena has already appointed Miss Charlotte Hoak special supervisor in this work and may possibly appoint another special supervisor during the year.—E. B. B.

The publisher of this magazine must certify to the postal authorities in order to get the second class rates, that the subscription list is "paid in advance." Please help us meet this requirement. Note the date on the label of your wrapper and send in your renewal before expiration. Moreover, attention to this little matter will save us about fifty dollars in postage stamps, as that is what it cost us to mail bills and reminders last year. This saving can go into illustrations or other improvements. Kindly coöperate.

The courses given in the past summer at the University of California by Prof. M. A. Bigelow, of Teachers College, Columbia University, were a source of much help in the teaching of nature-study and biology in the schools of this state. Large classes and much interest make us hope that we may secure the valuable services of Professor Bigelow again.—E. B. B.

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The University of Chicago **The School of Education**

Foreword

The NATURE-STUDY REVIEW should serve a wider constituency. There are thousands of teachers and nature students who need just the practical suggestions and the inspiration which its pages afford. It is the only magazine which is devoting itself exclusively to outlining successful work in nature study for the grades and to discussions of the teaching of the subject.

Normal schools, superintendents and teachers would subscribe to it, we are convinced, if they knew more about it.

Our subscribers are in limited localities. In most states, for instance, the subscriptions come from three or four cities, where someone has become acquainted with the magazine and has stimulated local enthusiasm.

The Editor asks your hearty co-operation in increasing our membership and widening the influence of the society and desires to call attention to the special offer made below. See also reverse side.

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VOL. 8 DECEMBER, 1912. No. 9

Annual Meeting and Election of Officers

The fifth annual meeting of the American Nature Study Society will be held in Cleveland, Ohio, December 30th and 31st in connection with the meeting of the American Association for the Advancement of Science which occurs from December 30th to January 4th. The headquarters will be at Hotel Statler. (The rates are $2.00 per day and upwards, European plan.)

The Council has made the nominations for officers to be elected at this meeting. All subscribers to this magazine are members of the Society and entitled to vote. If you are not to be in attendance at Cleveland, mail your ballot (printed on last page) to the Secretary, Elliot R. Downing, The University of Chicago, The School of Education, before Dec. 15, 1912. Seal the ballot in an envelope marked "For officers, 1912."

In connection with the election of officers, President Davis wishes announced his withdrawal as candidate for president, in favor of Mrs. Comstock.

PROGRAM.

MONDAY, DECEMBER 30TH, 2 P. M.—*A Summary of the Study of Agricultural Instruction in Rural Schools.* Address by the President. General discussion on various phases of Nature Study adapted to Rural Schools.

TUESDAY, DECEMBER 31ST, 10 A. M.—*Some Results of the Scientific Study of Children's Interests*, C. W. Finley of the State Normal School, Macomb, Ill. General discussion, led by Elliot R. Downing, The School of Education, The University of Chicago.

AFTERNOON, 2 P. M.—Meeting to be devoted to the discussion of the general policy of the Society, with special reference to organization of local branches. Grant Smith, of Chicago Teachers' College, will lead the discussion. Report of secretary-editor, and election of officers.

Some Common Minerals and Their Determination

W. A. Tarr, *University of Missouri.*

FIRST PAPER.

Children are keener observers than older persons. Countless natural objects are noticed by them that older people, even though they are naturalists, fail to observe at all. Familiarity has caused us to lose some of the keenness we once possessed. We should take advantage of this aptitude of children and help them to acquire a wide acquaintance with the natural objects around them. Teachers everywhere are doing this in their nature study work. Birds, flowers, plants of all kinds, insects, and animals are receiving their full share of attention by nature teachers. But the great field of inorganic nature is not touched by the vast majority of teachers, and yet the amount of material for such work is unlimited. It seems strange that a field so full of wonderful possibilities for study in the grades should have been and still is, neglected by nature teachers.

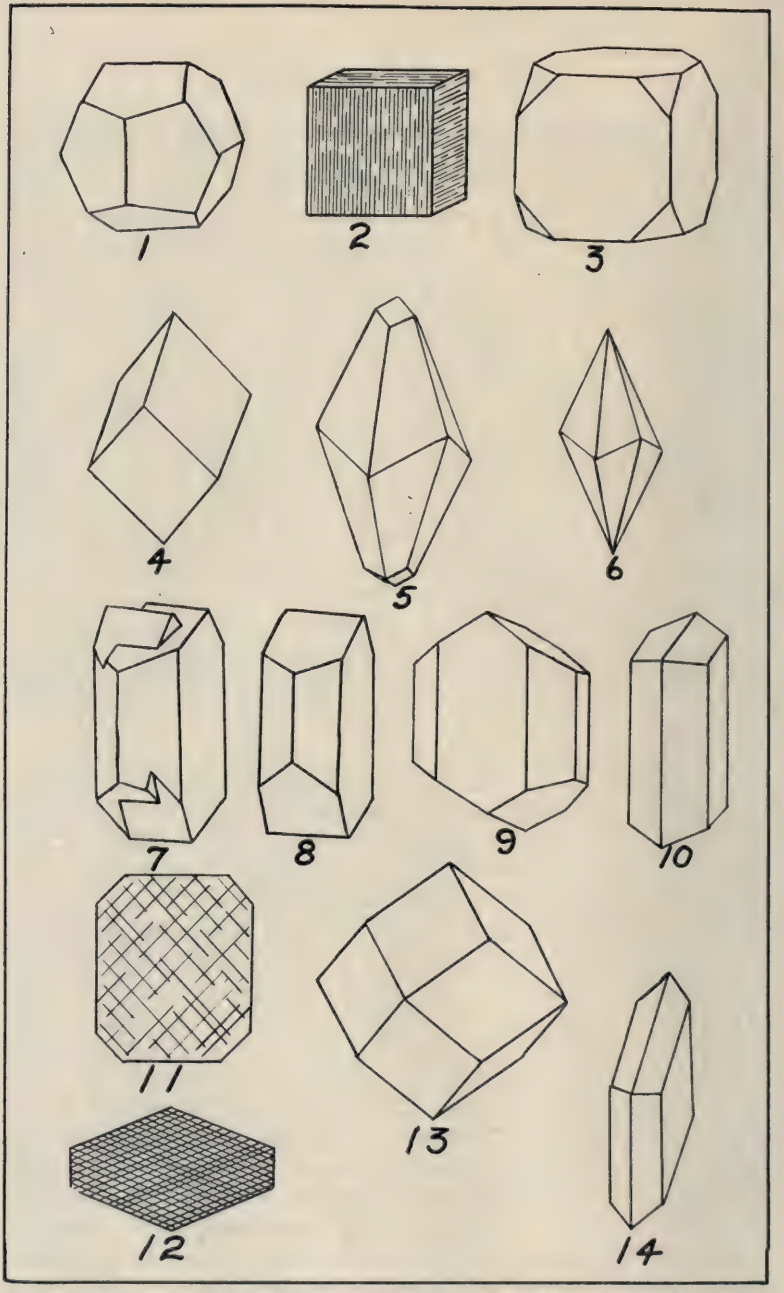
There are two reasons for this. One is that there is a lack of teachers who have a knowledge of geology, mineralogy, and chemistry, and the other is the common belief among nature teachers that the child has a more vital interest in life and its various forms. However true the last may be, it is no excuse for not assisting the child when its attention is attracted to crystals and rocks. I believe that if our teachers were qualified to answer the child's questions about such inanimate objects their interest in them would be as lively as in life forms. Girls are attracted by the form and color of minerals and rocks and often is an agate or piece of petrified wood found among the boy's pocket treasures. The world's greatest diamond mines in South Africa were discovered by a hunter observing a Kaffir boy playing marbles with some rounded pebbles, one of which attracted his attention by its brightness. This was the first diamond found in South Africa. The boy had found it in a nearby river near which the mines were afterwards located.

A collection of minerals and rocks is very easily made and a great deal of interest may be aroused among the children in the grades or students in the high school by having them make one. They can be kept in almost any kind of a box and the child itself can arrange compartments in the box by using wood or paste-

board for partitions. If manual training is taught the making of a box to hold twenty-five or fifty minerals would be a very good and useful exercise. A large class-room collection could easily be built up also. The specimens should be properly labeled and the finder's name given. Such collections are useful and ornamental when properly arranged and are no trouble to maintain or preserve. If the school is located in a region where mining is carried on the work and its value will be doubly interesting. In other regions the collection will be found useful in the work in geography in discussing various industries, especially mining, quarrying, and manufacturing. But the primary value lies in the actual working knowledge the child will acquire of the commoner rocks and minerals and of the uses of the same. And this knowledge can be imparted to the child through the medium of its own interest and desires. We do not have to wait until the children are in high school to give them their first introduction into the inorganic world.

It is the object of these papers to give to the teacher the characteristics and simpler methods of determining the commoner minerals and rocks, so that those teachers who are not versed in the subject may be enabled to include inorganic material in their nature study work.

A mineral may be described as a substance, found free in nature, having a definite chemical composition, and a certain definite shape, and as being inorganic in origin. Some parts of this definition need modifying and explaining. For instance the chemical composition is not absolutely exact in all cases. Some minerals have approximately a definite composition but we cannot say it is exact as for instance it is in quartz, which is silicon and oxygen in the ratio of one of the first and two of the last, or using chemical symbols for these elements, SiO_2. Further a pearl is not a mineral because its formation is due to an organic process, taking place in the oyster. It is well known that all substances are composed of molecules. The shape of the mineral, or its crystal form, is due to the definite arrangement of these molecules. While we cannot enter into this subject here, we can say that mineralogists have found that all minerals arrange their molecules about six different systems and all the crystal forms found in nature can be reduced to these six systems. These systems have names which suggest in a general way the shape of the crystal belonging to them. Thus, isometric (equal+measure) in which the crystals are the same size in all directions. The mineral, galena, is an example of this and occurs in cubes (see fig. 3).



COMMON FORMS OF CRYSTALS—1-2, pyrite; 3, galena; 4-6, calcite; 7-8, feldspar (variety, orthoclase); 9, augite; 10, hornblende; 11, a section through figure 9, along a plane perpendicular to the plane of the paper; 12, a similiar section through a hornblende crystal; 13, garnet; 14, gypsum.

It also cleaves in cubic form as will be described later. Hexagonal system or in six-sided crystals. Quartz is an example of this system (see fig. 17). Tetragonal system or in four-sided crystals, et cetera.

Minerals have several physical properties which it is necessary to know about in order to determine them even by simple methods. The most important of these are structure, hardness, cleavage, fracture, specific gravity, color, streak, luster, degree of transparency, taste, odor and feel. No mineral possesses all these properties but some one of them may be the *distinguishing feature* of some mineral. We will describe these properties as briefly and clearly as possible.

Structure.—This is the arrangement of the molecules in the crystal. In the single crystal this arrangement may produce prisms, pyramids, cubes, octahedrons, etc., and combinations of these. (See figures.)

Quartz illustrates such a combination as it invariably occurs in a form which shows a hexagonal prism and hexagonal pyramid (fig. 17). But when we deal with a mass of crystals, the individual crystals are generallly imperfect and the resulting forms may have various shapes depending on the shape of the imperfect crystals. Thus, we have fibrous forms when the mineral is made up of fibers as in the case of asbestus, or columnar, when it is composed of slender rods or columns. The fibers may radiate from a center and produce star like forms or they may be reticulated, the fibers crossing at various angles as in a net. When the mineral consists of leaves or plates, like in mica, the structure is lamellar. Sometimes the structure is granular, the mineral consisting of an aggregate of grains. Very commonly the mineral takes on an external form imitative of other familiar objects and this shape is named after it. When the shape is spherical or nearly so the form is known as globular. (The globules generally consist of radiating fibers.) Minerals containing long hairlike crystals are known as capillary minerals. Needle shaped forms are designated as acicular minerals and pendent columns, cylinders, or elongated cones are called stalactites.

Hardness.—This is the resistance a mineral offers to being scratched. We have found that all minerals can be scratched by the diamond so we say it is the hardest. As there are all grades of hardness a scale of hardness has been adopted ranging from one to ten, the diamond of course being number ten.

15, dolomite, shows curved faces; 16, calcite, variety Iceland spar, shows a cleavage rhomb and double refraction; 17, quartz; 18, calcite, variety dog-tooth spar (the small black specks are crystals of pyrite). (Slightly reduced.)

[1]While it is well to have a scale of hardness, for ordinary purposes the following method of determining the hardness will be found sufficient.

Very soft (below 2.5); can be scratched by the finger nail or very easily with a knife.

Soft (2.5-4); not scratched with the finger nail, but easily with a knife.

Hard (4-6); can be scratched with a knife, but not easily. Those from 5.5-6 only with a good knife.

Very hard (6-7); not scratched by a knife, but can be scratched by quartz.

Above 7; cannot be scratched by quartz. These minerals are comparatively rare.

A word of caution is necessary in regard to obtaining the hardness. Always break the mineral and get a fresh, unaltered surface. The outside of a specimen may be decomposed and will not give the true hardness.

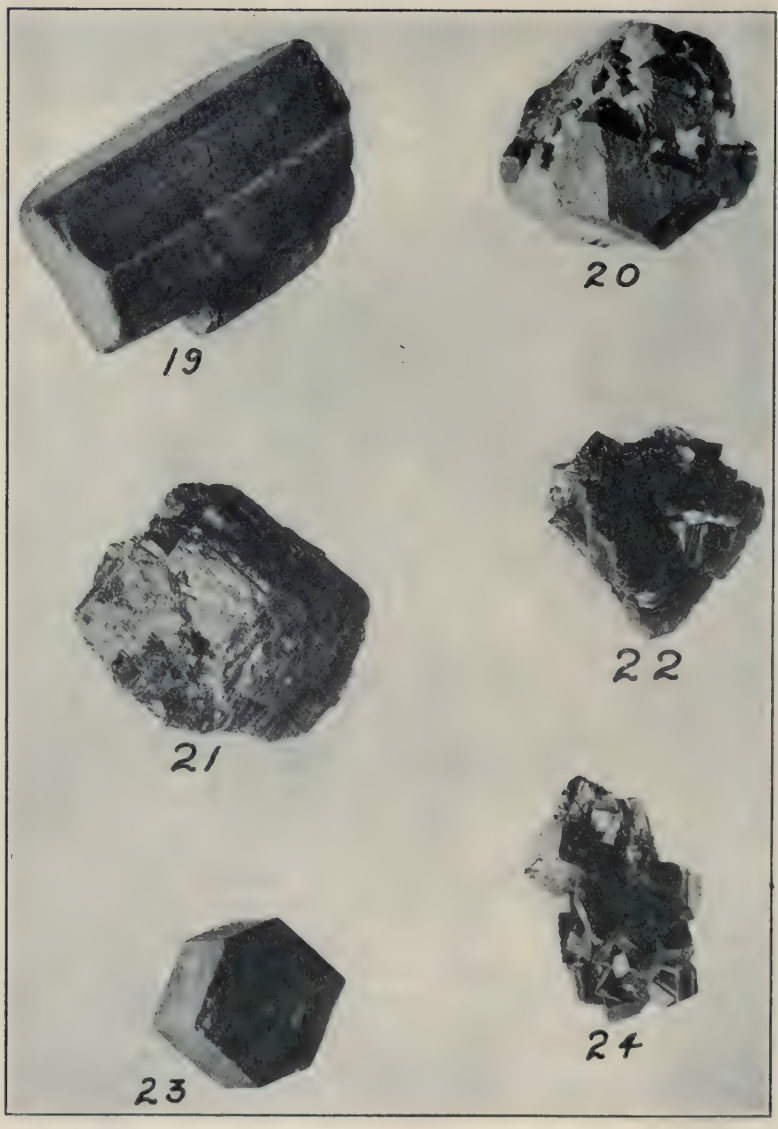
Cleavage.—Some minerals have a tendency to part or split along certain lines. This is called cleavage. It is generally parallel to a crystal face. Galena exhibits this very well and the resulting form is a cube, hence it is called cubic cleavage (fig. 21). Calcite also exhibits this property and always cleaves into rhombs (fig. 16. This figure illustrates also the property of double refraction by calcite.).

Fracture.—This is the kind of surface produced when a mineral breaks in any direction other than that of cleavage. It may be smooth or shell shaped (conchoidal) like flint or chert; or uneven; or hackly, when the elevations on the surface of the fracture are sharp and jagged as in broken iron.

Specific Gravity.—This is the ratio of the density of the mineral to water. Thus galena has a specific gravity of 7.5, which means that a cubic foot of galena will weigh 7.5 times as much as a cubic foot of water or 468.75 pounds. Minerals which consist largely of iron, copper, lead or other element with a high atomic weight, in general have high specific gravities. When no apparatus is at hand to obtain the specific gravity an estimate can be made by comparing it with a piece of quartz or something similar.

Color.—The colors of minerals include every color of the spectrum. In one group of minerals the smallest particle ob-

[1]This is the scale of hardness as used by mineralogists: 1.—Talc. 2.—Gypsum. 3.—Calcite. 4.—Fluorite. 5.—Apatite. 6.—Orthoclase. 7.—Quartz. 8.—Topaz. 9.—Corundum. 10.—Diamond.



19, feldspar; 20, crystal of galena, showing the cube and octahedron combined, also seen in figure 3; 21, galena, showing cubic cleavage; 22, sphalerite; 23, garnet (dodecahedron); 24, pyrite (note the striations on the cube faces. See figure 2.) (About two-thirds natural size.)

tained by crushing has the same color as the original. These minerals generally have a metallic luster, that is, they reflect light like a metal. In the other group of minerals the powder may have a different color from the larger mass. These minerals have an unmetallic luster. The colors of a single mineral are almost unlimited although in many cases there is a characteristic color which is fairly well adhered to by the mineral. In the table of minerals given the dominant color is given first and the less important ones follow.

Streak.—This is the color of the powder of the mineral. It is usually obtained by rubbing the mineral on a piece of unglazed porcelain or by scratching it. This is a great aid in determining some minerals.

Luster.—This is the property of reflecting light. It is possessed by all minerals but varies with the nature of the reflecting surface. Metallic luster has been mentioned above. Unmetallic luster is of several kinds, as follows. Vitreous, like broken glass and subvitreous, not so bright as vitreous. The luster is called resinous when it is like resin. Pearly when like pearl, as talc. Silky luster is the result of a fibrous structure. Admantine luster is a brilliant reflecting of the light as in the diamond.

Degree of Transparency.—A mineral is transparent when an object can be distinctly seen through it (fig. 16). Translucent, when light is transmitted but objects not seen. Opaque when no light is transmitted. All minerals exhibit these properties in some degree.

Fusibility.—Some minerals when heated will melt; while others will not. This can be determined sometimes by putting a small splinter of the mineral in a candle or alcohol flame.

Taste.—This is a property of soluble minerals. The commonest is the salty taste of the mineral salt or halite (it's mineralogical name). Soda has an alkaline taste, and epsom salts a bitter taste.

Odor.—Most minerals do not have an odor naturally but under certain conditions will give off an odor. The odor produced when pyrite is struck is sulphurous. The odor of moistened clay is argillaceous. Some limestones when struck give off a fetid odor.

Feel.—Some minerals feel smooth to the touch and others, such as talc, feel greasy.

There are over a thousand minerals and as many more species and varieties, but only about two hundred are well

known. Many minerals are represented by one specimen in some museum and a great many more are never seen outside of museums. The really common minerals number less than a hundred. F. W. Clarke[2] estimates the average mineralogical composition of the igneous rocks which have been described, as follows:

Quartz	12.0%
Feldspars	59.5%
Hornblende and pyroxene	16.8%
Mica	3.8%
Other minerals	7.9%
	100.0%

These figures are averages and do not indicate that any rock specimen would have these minerals in the above proportions. As we shall see later there are all variations possible in the amounts of minerals in igneous rocks. When we stop to think that igneous rocks constitute 95 per cent of the outer part of the earth we see at once how abundant these minerals are.

In some localities a collection of 25 minerals and rocks would be all that could be collected, while in other regions fifty or more common minerals could be collected very easily. By following the descriptions given below any teacher should be able to determine the common minerals which are found in his locality. The chemical composition is written out and the chemical formula is also given when a definite one is known. The common uses for each of the minerals are also given and they should be told to the scholar. While the minerals in the list are very widespread in occurrence there are many localities where only a few can be found. The descriptions are given in the order of their hardness, the softest first. This will aid in locating the probable descriptions of the mineral.

The method of using the table is as follows: Determine the hardness of the mineral as carefully as possible, being careful to use fresh material in doing so. Then locate it in the table by means of the first column. If there are one or more minerals that have the same hardness make use of the other physical properties of the mineral, such as color, structure, streak, luster, etc., in determining it. In a short time the especial features of each mineral that will distinguish it from the remainder will be remembered. Some of these especial features have been sug-

[2]Clarke, Bulletin 491, U. S. Geological Survey, p. 31.

gested in the column headed "Remarks." Where the minerals are very hard to distinguish, attention has been called to this fact and the best methods for telling them apart are suggested.

These notes correspond to the numbers in the table that follows: (1) This mineral is the result of the decomposition of minerals that contain aluminium, such as the feldspars of the granites, gneisses, etc. Where the decomposition has been extensive the beds of kaolin are very thick. The name comes from the Chinese word Kauling, which means *high-ridge*, and is the name of a hill in China where the material is obtained.

(2). Isinglass is a common name for mica but true isinglass is a nearly pure gelatin obtained from certain parts of such fish as sturgeon and cod. Both the micas are found in granites and other igneous rocks.

(3). Crystals of salt can be readily made in the schoolroom by allowing a concentrated solution of salt water to slowly evaporate. If a string is suspended in the solution the crystals will attach themselves to it. They occur in the form of cubes, very often with concave sides.

(4). Calcite is one of the commonest minerals known. It occurs in a great many crystal forms. Some of these are shown in the plate of figures. Limestone and marble consist largely of small calcite crystals. The varieties of this mineral are too numerous to mention here. The uses of calcite are almost as numerous. Besides its use in building operations, it has the following chemical uses: As a fertilizer: as a bleaching agent for cloth and rags, etc.; in the manufacture of soda, potash, and ammonia; in making wood alcohol; in refining mercury; in purifying coal gas; in the manufacture of glass and glazes; in making rubber, glue, dyeing fabrics, as a polishing material; in the manufacture of oils and soap; in making paints and varnish; in making paper; in preserving eggs; as a disinfectant and purifier of water and sewerage; in smelting the various ores; in sugar manufacture; in the tanning industry; and softening water.

(5). Hornblende is generally darker than pyroxene, occurs in long slender crystals, which are six-sided (see figure 10), and may be fibrous. Either the crystal or cleavage faces will give the characteristic outline that is shown in figure 12. Augite appears in section as in figure 11. The cross lines in both figures indicate the cleavage. It is best in hornblende.

See advertisement of minerals, Ward's Natural History Establishment, P. 344.

H.	COLOR.	STREAK.	SP. GR.	STRUCTURE.	CLEAVAGE FRACTURE.	LUSTER.	OTHER PROPERTI
0. 5 2. 5	White, grayish-white, yellowish.	White to grayish.	2. 6	Compact and soft earthy masses.	F. earthy. Brittle.	Earthy. Dull.	Opaque.
1. 5	White or colorless.	White.	0. 9	Massive. Snow flakes.	Nearly conchoidal. Brittle.	Vitreous.	Transparent. in thick lay
1. 5 2. 0	White, colorless gray, yellow, red, brown, etc.	White.	2. 3	Massive, fibrous and foliated.	Perfect in foliated and fibrous kinds. F. uneven.	Pearly Silky Dull.	Transparent selenite. Op
0. 5 2. 5	White, grayish, yellow, brown, red, blue, etc.	Like color.	2. 6	In compact, friable or earthy masses.	Earthy. Brittle.	Dull to pearly. Earthy.	Plastic when
2. 2 to 5	Black to green. (Biotite) colorless, gray, brown or pale green. (Muscovite)	White.	3. 1 to 2. 7	Foliated or micaceous.	Perfect cleavage. Very thin leaves may be obtained.	Splendent in biotite. Vitreous in muscovite. Pearly in both.	Biotite is tran to opaque Muscovite is parent to tra cent.
2. 5	Colorless or white, grayish, bluish, reddish and yellowish.	White.	2. 1 to 2. 6	Massive. Rarely seen in cubic crystals.	Cleaves into cubes. F. conchoidal.	Vitreous.	Transparent translucen Brittle.
2. 5 2. 75	Lead gray.	Same as color	7. 5	Massive and in crystals which are often cubes.	Perfect cleavage into cubes. F. uneven.	Metallic.	Opaque.
3	White or colorless, also gray, red, yellow, pink, honey yellow, green, etc.	White to grayish.	2. 7	Commonly in crystals, also massive, granular, or fibrous, stalactitic and nodular.	Always cleaves into rhombs. (See figure 16.)	Vitreous.	Transparen opaque. Efferv in HCl., diss completel
3	Reddish-brown, tarnishes easily to a deep purple and bluish color.	Grayish black.	5. 2	Massive, granular to compact.	Fracture uneven. Brittle.	Metallic.	Opaque.
3. 5 to 4	Yellow, brown, black, red.	Brownish to light yellow.	4	In crystals and massive.	Cleavage perfect. F. conchoidal.	Resinous when light colored.	Brittle. May be transl
3. 5 to 4	Brass-yellow, often tarnished and showing iridescent colors.	Greenish black.	4. 2	Massive.	Fracture uneven.	Metallic.	Brittle.
3. 5 to 4	Bright green	Paler green than the color.	4	Massive or incrusting other substances. Has radiating structure.	Fracture subconchoidal to uneven.	Fibrous kinds silky, crystals, vitreous to brilliant.	Banded in very ofte Brittle.
3. 5 to 4	Whitish, greenish-gray, black to brown.	White.	2. 9	Usually occurs in crystals. (See Remarks)	Cleavage perfect. F. sub-conchoidal.	Vitreous to pearly in some varieties.	Transparent translucen
5 5. 5	Some dark shade of brown, may be nearly black on outside.	Yellowish-brown.	3. 6 to 4	Stalactites or mammillary forms. Concretions massive and earthy.	F. uneven. Brittle.	Silky, dull to earthy.	May be very when earth Often in cubes alteration fr pyrite.
5 to 6	Various shades of green to black.	Gray to grayish green.	3. 2 to 3. 6	Crystals, either with or without crystal faces. Massive.	Cleavage fair. F. uneven to conchoidal. Brittle.	Vitreous to resinous. Dull.	Compare w hornblende

NAME.	COMPOSITION.	REMARKS.	USES.
Chalk.	Calcium carbonate. ($CaCo^3$)	Resembles white clay or kaolin but does not have the clayey odor. Crumbles easily in the fingers.	Used for making lime and cement. Other uses similar to calcite which see.
Ice.	Hydrogen and Oxygen. (H^2O)	Tasteless when pure. The ice on ponds may show prisms on melting.	Well known.
Gypsum.	Hydrous calcium sulphate. ($Ca\ SO^4.\ 2\ H^2O$)	The transparent foliated kind is called selenite. The fibrous kind satin spar, and the massive alabaster. Fig. 14.	It is burned and ground up and then known as Plaster-of-Paris. Used for making casts, moulds, finishing interior of houses, as a fertilizer. Alabaster is used for carving.
Kaolin or Clay.	Hyrdous aluminium silicate. ($Al^2O^3.\ 2\ SiO^2,\ 2\ H^2O$)	Has a greasy feel. Strong argillaceous odor when breathed upon. (1)	Used for making brick, tile, pottery, etc. Pure kaolin is used for porcelain.
Mica. Black is Biotite. Colorless or gray one is Muscovite.	Complex potash, aluminium silicate. Biotite has magnesium and iron also.	Biotite is brown by transmitted light. The cleavage plates are flexible and elastic. (2)	Muscovite is the mica that is commonly used. Its uses are insulating material for electrical apparatus, in doors of stoves and furnaces, for spangles on wall paper and certain brocades, and frosting on Christmas cards.
Halite or Salt. (Common)	Sodium chloride. ($Na\ Cl$)	Readily soluble in water. Saline taste. (3)	The uses are well known.
Galena	Lead sulphide ($Pb\ S$) May contain silver,	The high specific gravity and cubic cleavage make this mineral easy to determine. Figures 3, 20 and 21.	Lead is used for solders, pipe for plumbing, shot, and many other uses. When galena contains sufficient silver it is mined for that. It is then called argentiferous galena.
Calcite.	Calcium carbonate. ($CaCO^3$)	The cleavage form and the hardness make it easy to determine this mineral. (4) Figures 4, 6, 16 and 18.	Few minerals have so wide a variety of uses as lime. A very few are given. They are, in plasters and mortars, cement, etc. The chemical uses are very numerous: fertilizers, bleaching powders, gas and glass manufacture, etc. (4)
Bornite.	Copper, iron sulphide. ($Cu_5\ Fe\ S_4$)	Readily tarnishes on exposure. Occurs with quartz and chalcopyrite. Called Peacock ore.	An ore of copper. Contains 63.3% copper.
Sphalerite. (Zinc blende) (Black-jack)	Zinc sulphide. ($ZnS.$)	The resinous appearance and hardness make this an easy mineral to determine. Fig. 22.	The most common ore of zinc.
Chalcopyrite. (Copper pyrites)	Copper-iron sulphide. ($Cu\ Fe\ S_2$)	Its hardness and color make it easy to distinguish from pyrite and bornite. The black objects on the crystals in Fig. 15 are chalcopyrite.	A very common ore of copper. Contains 34.5% of copper.
Malachite.	Copper carbonate. ($CuCO^3.\ Cu\ (OH)^2$)	Malcahite is often interbanded with azurite, a blue copper mineral of nearly same composition. May occur as stalactites.	A common ore of copper. Much prized for gems, especially where interbanded with azurite.
Dolomite. (Pearl spar)	Calcium and magnesium carbonate. ($(Ca\ Mg)\ CO^3$)	The crystal faces of this mineral are always curved so the crystals look like saddles. See Fig. 15.	Many of its uses are the same as for calcite. Used as refractory material for lining furnaces, etc., for making Epsom salts, and many others.
Limonite.	Hydrous iron oxide. ($2\ Fe^2O^3.\ 3\ H^2O$)	Usually has a fibrous structure. When earthy it is brownish yellow to ochre yellow. Very common iron oxide.	Used as an ore of iron. The earthy kinds when ground are used for paint.
Pyroxene Augite.	Calcium, magnesium, iron, aluminium silicate. (Complex)	Usually short, thick prisms, which are nearly square. Figures 9 & 11. This mineral is common in some igneous rocks and is hard to tell from hornblende.	This is a very common mineral in igneous rocks.

H.	COLOR.	STREAK.	SP. GR.	STRUCTURE.	CLEAVAGE FRACTURE.	LUSTER.	OTHER PROPERTIES
5 to 6	Usually darker than pyroxene. Nearly black, also various shades of greens and browns.	White or greenish.	2. 9 to 3. 4	When in good crystals, they are long and slender, 6-sided, diamond shaped.	Cleavage good. F. sub-conchoidal to uneven. Brittle.	Vitreous. Pearly on cleavage faces.	Crystals longer more slender t pyroxene. Compare with pyroxene.
5. 5 to 6. 5	Iron-black, blackish-red to cherry-red.	Red.	4. 9 5. 3	Massive. Kidney-shaped masses with radiating fibres. Earthy.	Cleavage, none. Fracture uneven. Brittle.	Metallic to dull.	May be slightl magnetic.
6 to 6. 5	Flesh-red, white, pink, red, yellow, sometimes dark-gray or green.	White.	2. 55 to 2. 75	In crystals and cleavable masses. The angle between cleavage faces is 90° or nearly 90°.	Perfect at nearly 90° to each other. F. conchoidal to uneven. Brittle.	Vitreous. Pearly.	Some varieties a beautiful plag colors, blue, gre gold, etc. So show fine para striations on one the cleavage pla
6 to 6. 5	Pale. Brass-yellow, brown from tarnish.	Greenish-black.	5	Massive Stalactites, nodules, and very commonly in cubes and 12-sided forms.	F. uneven. Brittle.	Metallic.	Has striations on faces of the cu (usually) that ar ways at right an between any tw faces.
6. 5 to 7. 5	Red, brown, black, but there are many shades of these.	White.	3. 15 to 4. 38	Nearly always in crystals, 12-sided ones being common. Massive.	Cl. poor. F. sub-conchoidal to uneven. Brittle.	Vitreous. Resinous.	
6. 5 to 7	Green, oil-green, olive-green.	White.	3. 4	Usually in grains or granular.	Fracture conchoidal. Brittle.	Vitreous. Glassy.	Transparent to translucent.
7	White or colorless. Purple, red, brown, yellow, etc.	White.	2. 65	Prisms and pyramids. Massive.	Fracture conchoidal. Uneven in massive forms. Brittle to tough.	Vitreous. Glassy. Greasy.	Transparent to translucent.
7	Translucent to opaque. May be uniformly banded as in onyx and agate. Clouded, called moss-agate, opaque, red, brown, yellow called jasper. Opaque or nearly so, and black to gray to white. Flint and chert.	Generally white. If colored streak is sometimes the same.	2. 65	Compact and flint-like. Occurs lining cavities. The interior may be covered with crystals on top of the banding and is then called a geode. The interior may also look like a bunch of grapes.	The fracture is always conchoidal. Tough. Sometimes splintering.	WAXY to dull. The luster of most of these is nearly that of wax. This is especially true of the transparent to translucent variety called chalcedony.	Transparent, translucent and opaque.

NAME.	COMPOSITION.	REMARKS.	USES.
Amphibole Hornblende.	Similar to pyroxene.	These minerals occur in many igneous rocks, and are generally in forms without the crystal faces. See note 5. Also Figures 10 and 12.	This also is a very common mineral in igneous and metamorphic rocks.
Hematite.	Iron oxide. (Fe^2O^3)	May occur in thin plates or scales (micaceous), which have a brilliant luster. Crystals often have an iridescent tarnish. The scaly variety seems soft.	This mineral furnishes nine-tenths of the ore mined in U. S. today. Earthy kinds are used for red paints. Massive varieties may be ground for a polishing powder (jewelers' rouge).
Feldspar. Varieties are: Orthoclase, (commonly in granite) Plagioclase This includes several varieties that are similar).	Aluminium silicates of potash, soda and calcium. Orthoclase is ($K Al Si^3O^8$)	Feldspar is the family name for several similar minerals as noted under name. The untrained observer cannot separate them so they are grouped together. Feldspar constitutes nearly 60% of the average igneous rock, hence it is very abundant in igneous and metamorphic rocks. Figures 7, 8 and 19.	Used as a constituent of pottery and porcelain, generally in the glaze, but also in the body of the ware. Sometimes used to make artificial teeth. Some varieties are used for gems, i. e., the moonstone and sunstone.
Pyrite. (Fool's gold.) Figures 1, 2 and 24.	Iron sulphide. (FeS_2)	Pyrite occurs in all kinds of rocks and with other sulphides. Very common. Often seen in coal. A similar mineral is white iron pyrites, but it requires much experience to distinguish them.	It is burned and the sulphur fumes used to make sulphuric acid. Copper or gold are often found in it and when in sufficient amounts it is mined for either one.
Garnet.	Complex calcium, (or) (and) iron (or) (and) magnesium, or aluminium silicates.	Occurs in isometric crystals in schists, gneisses and crystalline limestone. Several varieties are known and the elements mentioned are variously combined. Fig. 23.	As an abrasive. Those garnets of good color are used as gems. It is the birthstone for January.
Olivine.	Magnesium, iron silicate. ($(MgFe)^2SiO^4$)	The hardness, color and mode of occurrence in basalts as rounded grains make this mineral easy to determine.	Sometimes used as a gem.
Quartz. The various varieties of this mineral are given below: Purple var. is the amethyst, also have milky, rose, and smoky quartz.	Silicon dioxide. (SiO^2)	When crystallized has a 6-sided pyramid on the end of 6-sided prism. Keep in mind its hardness, luster, fracture and form as the best determinative features. See Fig. 17.	Gems, abrasives (for sand paper, grindstones, etc.). In form of sand used for glass making; in mortars and cements; as refractory material. Rock crystal is used by some people for "crystal gazing."
Transparent to translucent; chalcedony. Red chalcedony is carnelian: Green, with red spots is the bloodstone, Jasper for March. Banded, with various colors, agate. In onyx the bands are straight.	SiO^2	Quartz either as the crystalline variety, or compact kind, is found everywhere. It forms the sand dunes and sandstones. It is found in veins with the valuable metals. It is an essential constituent of granite and is found in many other igneous rocks. Flint and chert are found in chalk and limestone in form of nodules. When silicon dioxide contains water it does not crystallize and is known as the opal.	Agates and mossagates are known to every school-boy. They are also widely used as ornaments. Onyx is used for making cameos. Flint, chert, etc., are crushed and used as road-making materials.

A Successful One-Acre Garden

DUDLEY MCCLELLAN.

As I was on the Page County Boys' Corn Judging Team last year and went to the Ames Short Course, I thought I would like to go again this year. As the Clarinda Trust and Savings Bank offered $2.00 cash as premiums for the boys growing the most corn to an acre in Page County, I thought this might be a good chance to earn some money to help pay my expenses. The short courses at Ames are helpful to the boy in many ways. They teach all about farming and stock raising, etc.

My father let me have the use of an acre of ground. This acre of ground lies on bottom land and at the east end of the field and is drained by two strings of tile. There is a big hill and railroad grade just south of this field, and my father and some of the neighbors think they kept the hot winds from hurting the corn.

I secured some Reid's Yellow Dent seed corn from a neighbor, Mr. J. E. Sawhill, living one mile northeast of us. I paid $1.00 per bushel for it, and we planted it with an old style Moline planter. The rows were three and one half feet one way and a little closer the other, as the marker was a little bit short. We planted it about the 12th of May.

I disced the ground three times before plowing and once after

it was plowed. I also harrowed it three times before planting and once afterward.

I began cultivating just as soon as it was large enough. I cultivated the corn four times with a four shovel walking cultivator. I laid it by with a six shovel riding cultivator about the last of June.

I did not have much trouble with the grasshoppers or the cutworms, but I had a little trouble with the moles.

We harvested the corn about the twentieth of October. Three of our neighbors came in and saw the land measured and helped husk and weigh the corn.

I have learned by this year's experience that you cannot disc the ground *too* much before plowing. I believe in discing thoroughly before plowing, because it helps to retain the moisture.

I have picked out five bushels of choice seed corn, which I sold to a neighbor for $1.50 per bushel. I cribbed part of the corn and we fed the rest to some pure bred Duroc Jersey hogs.

I took fifteen ears to the County Fair, which I picked from this field of corn, and won first, a premium of $5.00. I also took thirty ears to the Farmers' Institute and won second, a premium of $10.00. Then I won first on the acre yield for Page County, the premium being $40.00 for this.

So you see I have won plenty of money on my corn to take me to the Ames Short Course and now I have some left to put in the bank.—Dudley McClelland, Clarinda, Page County, Iowa, age 14.

Physical and Chemical Nature Study

JOHN WILKES SHEPHERD.

First Paper.

As the title might indicate, physical and chemical nature study deals with the materials that ordinarily are used in physics and chemistry. But, since the aim and not the material determines a subject of study, it is therefore possible for nature study and these sciences to deal with the same materials.

It is no longer necessary to discuss at length the aim and method of nature study, because they are fairly well understood and agreed to by all. It is now quite generally accepted that in this subject children are to do work with things. This work with things should be worth while to them both at the time they are doing it and also at subsequent times. In other words, in nature

study, children should learn to do those things which will have repeated applications, and in the doing of which the children get control over them, to the end that they will increasingly utilize their physical surroundings. This procedure is in accordance with the present aims of education and also with human happiness and progress.

From the beginning, nature study has concerned itself almost wholly with those materials which belong to the biological sciences. In the growth of the subject, aims have shifted until now it is generally conceded that so far as constructive plant work is concerned the effort should be to produce vigorous growing plants *to be used* in various ways. For example, children are furnished opportunities to grow flowering plants for school and home decoration, or vegetables and other useful plants; furthermore, in after life they will want, and know how to grow these and other plants. In such work children are getting control over plants by their experiences with them. And this seems to the writer to be the best way to get such control.

What is true for biological nature study is equally true for physical and chemical nature study, namely, all nature study should make an appeal to children at the time they are working at it, and in addition it should be worth while in later times.

One of the fundamentals with which children and other people everywhere are concerned is the law of the lever. A study with some of its applications therefore might be made with profit and pleasure by the children of the upper grades in our elementary schools. A satisfactory place to begin such study has been found in the use of a simple equal-armed balance. Such a balance together with weights may be made by the children with such tools as they may have at home. The balances could be constructed at home, or they may be made in the manual training shop at school. A simple and satisfactory balance may be made of three pieces of wood and of pans and thread. The pieces of wood are the base 4″x4″ and $\frac{3}{4}$″ thick, an upright support $\frac{3}{4}$″x$\frac{3}{4}$″ and 8″ long, and a beam $\frac{3}{16}$″x$\frac{3}{4}$″ and 12$\frac{1}{2}$″ long. The upright is mortised into the base and the beam supported by a pin in the upright near the top. Scale pans are made from the tops of baking powder cans, and are supported by means of thread. The essentials of a good balance that children can make are two: First, the arms must be equal and constant in length (the arms are those parts of the beam between the support, fulcrum, and the points of suspension of the pans), and secondly, the beam should have a free and easy movement on the fulcrum. It is not necessary for the beam to

balance without the pans; neither is it necessary for the pans to be of equal weight, nor do the suspending threads need to be of the same length. It is necessary, however, for the arms and the attached pans to balance each other.

Weights may be made from zinc, tin, sheet lead or heavy cardboard. A rectangular piece of either could be weighed on a druggist's or grocer's balance, and then cut into desirable sizes; or weights may be made by putting dry, fairly coarse sand, or small shot into little bags, the bags and contents constituting the weights.

These balances are not as sensitive as those to be found in high school and other laboratories, and neither are the weights as accurate. The children can make balances and weights, however, of sufficient accuracy to satisfy their needs, but this statement does not mean that they should put together a makeshift affair in which they have no confidence. On the contrary, they should make the best balance of which they are capable, and this best is good enough.

Needless to say, there should be some motive other than the construction of the balance, if one wishes the best effort of which the children are capable. That is to say, even before the balances have been planned the children should have some use to which they wish to put them. For instance, it is easy to conceive in connection with physiology that children might be interested in determining approximately the amount of water in food stuffs, for example, in apples, carrots, turnips or potatoes. The firmness with which such motive holds the children, together with the pleasure they get from making things, will determine very largely both the value of the work and the general appearance of the balances.

In addition to the work with the balances in connection with the water in food stuffs, the children would be interested in and profit by other studies with the lever. Already they will have found that equal weights operating at equal distances from the fulcrum counter-balance each other. For example, the body that weighs one ounce is balanced by a weight of one ounce. The balance is one application of the law, "the weight x weight arm equals the power x power arm."

A further study of the same law may be made by the children through experimentation, with but a slight modification of their balances. As a result of such experimentation the children would be able to understand much in the mechanical world which they do not understand; moreover, thereby they will be enabled

to utilize levers with a thorough understanding of them ever afterward.

This further work with the lever could be done in connection with studies in applied mathematics, and with a slight modification of their balances, as follows: The scale-pans and supporting thread should be removed from the beam, thus leaving the upright with the beam in horizontal position. (For this work it might be necessary to balance the beam, inasmuch as it must be in balance.) It will be necessary also to furnish weights with points of attachment, which may be either hooks or loops of thread. Whatever the means of attachment used, they will help constitute the weights. When the apparatus has been provided, the experimental work may be done through the solution of sets of problems of two types: (1) What weight attached to one arm four inches from the fulcrum will balance two ounces on the other arm six inches from the fulcrum? (2) What distance must a two-ounce weight be placed from the fulcrum on one arm in order to balance a three-ounce weight on the other arm, four inches from the fulcrum? Many problems of each of these types should be solved by the children and the work might be done at home or at school as seemed best. The problems could be modified in statement in order to have variety as well as to develop power in interpretation. Problems of the type (1) could be stated—given a two-ounce weight six inches from the fulcrum to find its counterpoise four inches from the fulcrum; problems of type (2), given a three-ounce weight four inches from the fulcrum to find the distance from the fulcrum at which two ounces will balance it.

One of the results of work of this sort will be to teach the children to be careful in measurements and also to duplicate these measurements in order that their work be satisfactory. It is quite possible that two children may disagree as to the solution of some of the problems given, in fact, it usually happens that such does occur and children will readily decide that any such disagreement and settlement should be made before the whole class, each party to the disagreement bringing his or her balance and weights in order to justify his or her position. If properly carried out, such attempt at justification is worthy and wholesome. Another valuable influence in connection with such procedure is that the children make and remake, modify and more nearly perfect their balances from time to time. The teacher in all cases must decide how far to go in the study, when to move on to something new, how to direct the work so as to make it of most value, not only

in point of subject attainment, but also in order to give them proper basis for conclusions. It is not an easy matter for the boy or girl in the grammar grades to abandon a position for which he or she has contended, and peculiarly enough it is those who need the training this work should give who are least disposed to abandon an opinion already formed. In fact, it is quite usual for children to conceive that their chief business is to stand by some statement which they have made before their classmates whether or not they can justify themselves for so doing. In such cases it is a happy situation to have them face a problem whose solution is not merely verbal and whose standing is not determined by discussion and debate. In all work the children must make good with the material with which they are concerned. This making good means that when the opinion has been formed it must be capable of demonstration and of being approved by experiment. Some times a grammar grade room has spent several months of their school year working with balances in the solution of problems with which they were concerned.

It is quite possible at the end of a carefully planned study to have the children work out the law governing the application of the lever and to state it, although probably not, in fact usually not, as it is stated in the science of physics. Many statements have been made by children who have done the work herein indicated which revealed proportions or ratios, simply because the children making the study were at the time concerned with ratio and proportion in mathematics. One need not argue on this occasion that it is worth while for everybody to know something of the application of the lever, because it is not only everywhere present but because there come times when all of us can use this law to our advantage.

Chicago Teachers' College.

Children's Interest in Nature Material

Elliot R. Downing.

The native interest of the child in the materials used for instruction is one important criterion in the selection of subject matter. If the end to be accomplished by the school can be achieved through the use of inherently attractive material, surely, it is an economy of effort to use such. Moreover, recent studies (Thorndyke, *Popular Science Monthly,* November 1912, etc.) seem to show that interest is prophetic of achievement and is a much more permanent thing than was earlier supposed.

In the last number of the Review, Miss Mau gave some interesting results of schoolroom studies of children's interest in nature material. Mr. Chas. W. Finley carried out a similar investigation the previous year while a student in the School of Education here. It seemed to the writer worth while to undertake, as a check on these results, the classification of the questions asked by children regarding nature phenomena in the pages of *St. Nicholas,* under the department headed "We Will Ask St. Nicholas About It" or "Because We Want to Know." The questions are purely voluntary on the part of children. They are not stimulated by any questionaire and so represent the normal interests of the child somewhat better perhaps than schoolroom experiments which are conducted necessarily under somewhat artificial conditions. This department began in *St. Nicholas,* in November, 1899, Volume 27, and has continued to the present. The material of this study includes all of these questions and observations up to the end of April of the present year. These letters represent only a fraction of those that have been received by *St. Nicholas,* as the following extract from a letter from Edward F. Bigelow, who edits the department indicates.

Arcadia, Sound Beach, Conn., Oct. 10, 1912.

My Dear Mr. Downing:

In reply to your inquiry of the fifth, will state that only a very small percentage of letters received from children are published in my department, "Nature and Science," of *St. Nicholas.* It varies greatly from month to month. We publish only as we have room, which is only a very few each month—a selection from those that seem of greatest general interest and remotest from those we have already published.

Yours very truly,

Edward F. Bigelow.

It is quite apparent that the letters that are printed are more or less typical and the data are herewith presented. The same question was answered in the department only three times. There were 732 children who asked questions or made observations, of whom 301 were boys and 441 girls: 116 of the boys gave their ages and 173 of the girls. The average age of the boys was 11.90 years, of the girls 12.08 years. It is to be noted that Miss Mau in her investigations was dealing with much younger children,—those from the kindergarten to the third grade, so that a comparison of results will help us see what changes there are in the child's interest with advancing years.

GRAPH OF CHILDREN'S INTERESTS.—A, Plant Material; B, Animal; C, Physical; D, Miscellany. One-sixteenth inch equals one per cent.

The *St. Nicholas* data themselves threw little or no light on this question, since the distribution of children by age merely shows at what age *St. Nicholas* is usually taken, rather than the relative interests of the children at various ages. Observations are given in 295 cases; 447 questions are asked, making a total of 742. Of this total 20.6 per cent concerns plant material, 61 per cent animal material, 11.6 per cent physical material and 1.8 per cent miscellany that can be classed under neither of these heads, largely observations on the enjoyment of the beauty and companionship of nature. The graphic representation of these percentages makes it very clear that a child's interest in animals is the major interest and if we may accept Miss Mau's results as a basis for a fair comparison, the animal interests increase from the early grades to the upper grades.

Miss Mau stated that the

most striking differences in her studies were, not so much the differences in the interest of varied materials, as the differences between the preferences of boys and girls in the same material. The *St. Nicholas* results differ from hers in that respect, as the following totals show:

Percentage of all boys who wrote regarding plant material, 21.26 per cent; of girls, 20.18.

Percentage of all boys who wrote regarding animal material, 62.16 per cent; of girls, 60.32.

Percentage of all boys who wrote regarding physical material, 15.28 per cent; of girls, 17.46.

Percentage of all boys who write regarding miscellany, 1.34 per cent; of girls, 2.04.

As far as there are differences they are rather surprising. Boys write more often of plant materials than do girls and girls more regarding physical phenomena than boys.

The following totals show the classification of plant, animal and physical material under several subdivisions. The per cents given in each case are the per cents of the total questions and observations in each group—plant, animal, physical.

Plant Material.	No. of Observations	No. of Questions.	Total in Per Cents.
Trees	13	23	23.53
Garden flowering plants	8	5	8.50
Garden vegetables and fruits	7	15	14.38
Wild flowering plants	24	32	36.60
Wild spore-bearers	10	16	16.99
	62	91	100.00

Animal Material.	No. of Observations	No. of Questions.	Total in Per Cents.
Physiology (Human)	1	3	0.88
Indians		3	0.66
Mammals	44	40	18.54
Birds	68	42	24.27
Reptiles	16	29	9.94
Amphibians	4	12	3.53
Fish	5	25	6.63
Spiders	4	9	2.87
Insects	41	72	24.95
Other invertebrates	15	20	7.73
	198	255	100.00

Physical Material.	No. of Observations	No. of Questions.	Total in Per Cents.
Physical Material.			
Astronomical		20	16.26
Geographical and Geological	12	18	24.39
Industrial		3	2.44
Mechanical		4	3.25
Mineralogical		6	4.88
Physical	11	41	42.28
Photographic	2	6	6.50
	25	98	100.00
Miscellany	10	3	

It is to be noted that among animals, the chief interest seems to center in insects, then birds follow as the next most interesting topic, then mammals. Among the latter group, the questions and observations pertain largely to the wild mammals. Out of a total of eighty-four, only nineteen pertain to pets and four to horses. It is rather surprising that the domestic animals come in for so small a share of the child's interest. With plants too, the wild forms seem to have a larger interest for the child than the garden flowering plants and vegetables. It is difficult, of course, to interpret these results, as they may mean so many different things. It may be that questions regarding the common animals and plants around the house are more readily answered at home and the questions to *St. Nicholas* are the residue of unanswered queries, so that the less familiar plants would come in for a larger share of questions. Among the animals the maximum number of questions seem to be upon the forms that are, as a rule, most numerous.

Classifying the material in the letters on another basis, the per cents in each group—plant, animal and physical material—are given with respect to care, activities, etc. The table follows:

The figures express again per cents of the total questions and observations in each group—plants, animal and physical materials.

	Plant.	Animal.	Physical.
Activities	56.2	65.5	66.6
Care	1.3	4.8	2.5
Classification	1.9	2.4	1.6
Function of Parts	2.7	3.8	
Identification	24.8	13.9	21.9

Mental Traits		1.6	
Miscellany	6.55	1.6	2.5
Structure	6.55	6.4	4.9

The activities of plant, animal and physical material come in for the major share of attention. The activities of the plant and animal might better perhaps be given under the term habits, but in order to include under the same heading the similar questions and observations regarding physical materials, the word activities has been used.

Many of the questions under plant and animal activities are of the "What Why" form, as "What makes a grape grow double?" "Why do leaves change color in autumn?" "Why does a gold fish turn white?" They seem to signify a desire to be informed as to the causes which operate to produce the action rather than regarding the ultimate reasons in each case, so I have put in no "Why—What" class.

The results of Mr. Finley's and Miss Mau's studies are largely unpublished, so I may not make comparisons now, but leave this material to be used later for such discussion. I am quite sure such comparative study will be instructive.

News and Notes

At a section meeting of the Michigan State Teachers' Association in the auditorium of Fountain Street Baptist Church, Grand Rapids, a special meeting was called to consider the organization of a state association to unify the nature-study and school-garden interests in the state. Following a paper by Dr. Leroy Harvey on "School Gardening a Fundamental Factor in Education," the meeting was called to order and Prof. Praeger of Kalamazoo College was elected temporary chairman and Ora May Carrel of Grand Rapids elected temporary secretary. An interesting discussion on the benefits to be derived from such an organization followed, and it was gratifying to learn that several Michigan cities already have nature-study clubs and school garden clubs, and that the unanimous opinion of all present was for an organization bringing these forces together for greater efficiency. A motion that the organization be known as the Michigan Nature-Study and School-Garden Association and that they meet next year as a round-table section of the M. S. T. A. was adopted.

A committee of five was elected to effect an organization and to nominate and elect permanent officers, this committee to report at the next regular meeting in October, 1913. Members of the committee elected were Dr. Leroy Harvey, Western State Normal, Kalamazoo, Mich; Mrs. Lou Sigler, Principal Buchanan Avenue School, Grand Rapids; Prof. W. H. French, Michigan Agricultural College, Lansing; Mr. Mallory and Prof. Magers, Northern State Normal, Marquette, Mich.—Ora May Carrel, Temporary Secretary.

Members of the Grand Rapids Nature-Study Society were favored with a perfect autumn day on their first field trip, Saturday, October 26th. The party left Comstock Park at 10 a. m. and followed the road along Grand River for several miles. Especial notice was taken of the different species of oaks, and the brilliant scarlet oaks together with species of various shades and tints provided a panorama which, blended with the landscape of a continuous line of hills and valleys, made an impression of nature color and harmony that will long be a pleasant memory. The party returned from Belmont via G. R. & I. R. R. at 4:45 p. m.

The following is the program of the Rockford Nature-Study Society for 1912-1913. The sessions are held at four o'clock in the High School chemistry lecture room:

October 2nd.—"Trees of our City Parks," Miss Vera Sheldon, Mr. P. B. Riis.

November 18th.—"The Country Life Commission," Miss Ada Waldo.

December 16th.—"Home and School Gardens at the Harlem Consolidated School," Mr. C. C. Burns.

January 20th.—"Oral Hygiene," Dr. M. R. Harned.

February 17th.—"Conservation of Bird Life," Miss Myra Banks.

March 17th.—Open meeting, High School Auditorium, eight o'clock, speaker, Elliot R. Downing.

April 14th.—"A Wild-Flower Garden," Mr. Norman Nelson.

Following this is the annual business meeting and field trip.

At our last meeting it was voted to secure and publish a list of the trees of the region, and to ask the Park Board to cooperate with us in securing the labelling of the trees in the parks of the city. So you may know we are going to make ourselves useful.—Ruth Marshall, Rockford, Ill.

Book Reviews

A History of the Birds of Colorado, by William Lutley Sclater, M. A. (Oxon), M. B. O. U., Hon. M. A. O. U., and recently director at the Colorado College Museum. Witherby & Co., 326 High Holborn, London, 1912. Price $5.00. American agents, Stechert & Co., West 20th St., New York. Pp. XXIV+576. Sixteen text figures.

This work is unusual in being prepared by an Englishman who had enjoyed only a brief residence in Colorado. It forms a handsome octavo volume illustrated by excellent half tones from photographs by R. B. Rockwell, E. R. Warren, L. J. Hersey and H. W. Nash. A contour map of Colorado and a frontispiece portrait of Gen. William J. Palmer are included. The Aiken "Collection of Colorado Birds and the Literature of Colorado Ornithology" form the basis for the work.

The text consists principally of the following: (1) a taxinomic treatment of the birds of the state with keys even for the orders as well as for smaller groups; and (2) short accounts of the habits, distribution, abundance, and time of occurrence for each species. There is a full bibliography in which the years are abbreviated without even an apostrophe to indicate the digits omitted. The introduction contains a few paragraphs on the physical features of the state and lists of birds arranged according to the time of their occurrence and according to verbical distribution.

It is unfortunate that a book involving so much work and expense for its publication should be marred by a large amount of bad English and by rather poor proof-reading. However the book should be useful to Colorado bird students in spite of these shortcomings and occasional bits of misinformation; and it looks well on library shelves.—R. M. Strong.

The Life of the Plant, C. A. Timiriazeff, Professor Emeritus, Moscow University. Translated by Anna Chéréméteff. 355 pages, 83 figures. $2.50 net. Longmans, Green & Co., 1912.

One of the earliest extensive text-books of botany to advocate a mechanistic conception of plant life was "The Life of the Plant." Although the book was first issued in 1878, and has passed through many editions in the Russian language, it has just now been translated into the English language. Such chapters as that on Science and Society, The Plant and the Animal,

and the Plant as a Source of Energy, added to the chapters upon the usual headings, suggest a point of view that is interesting. It is shown that practical considerations in the needs of society have made science possible, but that science, outrunning the causes that produced science, has gone into intellectual problems which, for the time at least, bear no immediate relation to the needs of society. But science does not prosper when she keeps long away from the needs of society. Thus botany, originating in practical needs, has from time to time busied itself with abstract matters, and then has been called back by considerations of a practical kind.

Even though a work on plant physiology, this book first considers plant structure as a background for studies of functions, and throughout, structure is constantly presented as an essential to physiological studies. Experiment, verification, and discussion that is often philosophic, characterize the method of the book. The mechanical interpretation of plants and animals is constantly urged. Little that is new appears, but the method of presentation is interesting and stimulating.—O. W. C.

When the Forests Are Ablaze, Katherine B. Judson. 380 pages. A. C. McClurg & Co., Chicago. $1.25.

"Uncle Tom's Cabin," Alcott's "Little Men and Little Women," Dicken's "David Copperfield," and novels of this sort, have been books of definite purposes looking toward the amelioration of social and economic conditions. It has almost come to be a trite saying that the author who would reach the masses and influence their opinions must put his message into a novel. The government has been issuing pamphlets on conservation of our forests; scientific papers have piled up statistics in a mass of overwhelming evidence, and yet, the negligence and carelessness and well-nigh wanton destruction still goes on. Here is wishing that this book may strike the popular fancy well enough to carry conviction to the everyday man and woman, as the other novels mentioned have done, for the problem of our forests is a live issue and one that intimately affects all of us.

The author has given us an exceedingly good love story. The setting is in the Western forests. The climax of the tale comes at the time of a forest fire. The heroine is an ex-schoolma'am, and the hero a government forester. The descriptions of the forest and of the fire are very good word pictures, and the entire atmosphere of the book is permeated with the aroma of big firs and the fragrant salal bushes.

Greyfriars' Bobby, Eleanor Atkinson. 292 pages. Harper & Bros. $1.35.

We have grown familiar with some animal classics like "Black Beauty" and "Beautiful Joe," wherein our animal friends have been deemed worthy of the place of heroes in literature. This new addition to books in which an animal's name gives a title to the story is eminently worthy a place in our esteem and a recognition in current good literature. One hardly knows on completing the book whether your most vivid impressions are of Bobby or of Greyfriars' church yard and the quaint characters that are connected with it. Bobby is a very winning, though a very natural dog. He does not dominate the story, but takes his natural place. He quite wins your heart as is intended for "his soft eyes, veiled by the silvery fringe that fell from his high forehead, were deep-brown pools of affection."

The scene of the story is in Edinburg at the beginning of the 19th century, "when it was a new gospel, at that time, that a dog or horse or a bird might have its mission in this world of making people kinder and happier." When the story is ended you are quite sure that Bobby and his kind have not preached the new gospel in vain. It is an eminently readable book.

Confidences or Talks With a Young Girl Concerning Herself. 94 pages. 50 cents.

Truths: Talks With the Boy. 95 pages. 50 cents.

Herself: Talks With Women. 221 pages. $1.00.

False Modesty. 110 pages. All by E. B. Lowry, Forbes & Co., Chicago.

This series of books is written by a man with a conscious mission. Mr. Lowry is evidently trying to face squarely the social evil and to remedy that as far as possible.

False Modesty discusses the vice that thrives through ignorance, as the author conceives it, and the chapters on "The Father's Duty to His Son," "Teaching the Science of Motherhood," and "The Coming Educational Reform" point out the lines along which the author thinks the social vice must be ameliorated.

Herself discusses in the early chapters the normal functions of the female reproductive organs and points out the connection of the "Black Plague," as the author styles venereal diseases, with the diseases that affect women, and the disruption of the home. There are also chapters on the instruction of children with some excellent advice on the prevention of the wrecking of the boy's or girl's life. The book is a clean, forceful and

plain discussion of the problems that intimately affect woman, the home and the social problem.

In *Confidences* and *Truths* the author has undertaken to tell to the boy or girl what should be known concerning the reproductive functions, so that if the parent does not feel confident to undertake the instruction, here are good books to put in the hands of the children, or better still, books to be read by the parent with a view to imparting the appropriate instruction to his child. *Confidences* is much more reserved in its expression than *Truths*, yet there seems to be good reason for being quite as frank with the boy as this book is, for in all probability he will pick up much of the information from less desirable sources, if such a frank discussion is not given him by the time he is twelve years of age.

After all, we may heartily commend this series as an excellent addition to the literature that is much needed at present in our American life.

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